APPENDIX A

RECORD OF DECISION

GURLEY PESTICIDE BURIAL SITE
SELMA, NORTH CAROLINA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

# RECORD OF DECISION
# SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

## GURLEY PESTICIDE BURIAL SITE
## SELMA, NORTH CAROLINA

**PREPARED BY:**

**U.S. ENVIRONMENTAL PROTECTION AGENCY**
**REGION 4**
**ATLANTA, GEORGIA**

**September 2006**

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## LIST OF ACRONYMS and ABBREVIATIONS

| | |
|---|---|
| ALM | Adult Lead Model |
| AOI | Analyte of Interest |
| APA | Acid Plant Area |
| ARAR | Applicable or Relevant and Appropriate Regulation |
| AST | Above Ground Storage Tank |
| BBL | Blasland, Bouck, & Lee, Inc. |
| bgs | below ground surface |
| CEC | Cation Exchange Capacity |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| COC | Contaminant of Concern |
| COPC | Contaminant of Potential Concern |
| Consent Order | Administrative Order by Consent |
| CRA | Conestoga Rovers & Associates |
| Eco-SSL | EPA Region 5 Ecological Soil Screening Level |
| ET | EPA Ecotox Threshold |
| EPA | United States Environmental Protection Agency |
| ERA | Ecological Risk Assessment |
| ERM | Environmental Resources Management |
| ExxonMobil | Exxon Mobil Corporation |
| Ft/day | Feet per day |
| Ft/ft | Feet per foot |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| ICM | Illinois Cereal Mills |
| LSA | Limited Site Assessment |
| MCL | Maximum Contaminant Level |
| meq/100g | milliequivalents per 100 grams |
| MEP | Maximum Extent Practicable |
| mg/kg | milligrams per kilogram or parts per million (ppm) |
| mg/L | milligrams per liter |
| NC | North Carolina |
| NCDENR | North Carolina Department of Environment and Natural Resources, formerly NCDEHNR |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| O&M | Operation and Maintenance |
| ORNL | Oak Ridge National Laboratory |
| PA | Preliminary Assessment |
| PAH | Polycyclic Aromatic Hydrocarbons |
| PBA | Pesticide Burial Area |
| PCB | polychlorinated biphenyls |

| | |
|---|---|
| PEC | Probable Effect Concentration |
| POLREP | Pollution Report |
| PPA | Prospective Purchaser Agreement |
| ppb | parts per billion |
| ppm | parts per million |
| PRB | Permeable Reactive Barrier |
| RAO | Remedial Action Objective |
| RBC | EPA Risk Based Concentration |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| RME | Reasonable Maximum Exposure |
| ROD | Record of Decision |
| SAP | Sampling and Analysis Plan |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| SRG | Soil Remediation Goal |
| SSAL | Site-Specific Action Level |
| SVOC | Semi-Volatile Organic Compound |
| TAL | Target Analyte List |
| TCL | Target Compound List |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TEC | Threshold Effect Concentration |
| TOC | Total Organic Carbon |
| TRV | Toxicological Reference Value |
| µg/dL | micrograms per deciliter |
| µg/L | micrograms per Liter |
| UAO | Unilateral Administrative Order |
| URSGWC | URG Greiner Woodward Clyde |
| USGS | United States Geological Survey |
| UST | Underground Storage Tank |
| VOC | Volatile Organic Compound |
| VPH | volatile petroleum hydrocarbon |
| WP | Work Plan |

# PART 1: THE DECLARATION

## 1.1 Site Name and Location

This Record of Decision (ROD) is for the Gurley Pesticide Burial Site, which is located on East Preston Street in Selma, Johnston County, North Carolina (NC). The United States Environmental Protection Agency (EPA) Site Identification Number is NCD986172526.

## 1.2 Statement of Basis and Purpose

This decision document presents the Selected Remedy for the Gurley Pesticide Burial Site (Site), in Selma, NC, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the Site. The State of North Carolina has provided a conditional concurrence with the Selected Remedy.

## 1.3 Assessment of Site

The response action selected in this Record of Decision is necessary to protect the public health or welfare and the environment from actual or threatened releases of hazardous substances to the environment.

## 1.4 Description of Selected Remedy

The overall clean-up strategy for this Site is to reduce the amount of contamination in soil and groundwater to protect both human and ecological receptors. The contaminated soils above the clean-up levels noted in Section 2.12.4.2 in the Acid Plant Area and the contaminated groundwater above the clean-up levels noted in Section 2.12.4.2 are considered to be "principal threat wastes" at the Site. The selected remedy removes the source material constituting principal threat at the Site. The major components for the Selected Remedy include:

- ❑ Excavating approximately 17,000 cubic yards of contaminated soil from the Acid Plant Area. Excavated waste will be tested to determine whether the soils are considered hazardous under RCRA for disposal purposes. Any soils categorized as RCRA hazardous waste will be treated to render the material non-hazardous prior to off-site land disposal in a RCRA Subtitle D landfill;
- ❑ Adding lime to the bottom of the excavation as appropriate to reduce the mobility of residual lead in the soil;
- ❑ Backfilling the excavation with clean soil and topsoil and seeding with grass;
- ❑ Installing a reactive treatment zone, such as a Permeable Reactive Barrier (PRB), in the path of impacted groundwater such that target contaminants are removed or altered by physical, chemical, and/or biological means;

- ❑ Monitoring groundwater to assess the effectiveness of the PRB and compliance with Applicable or Relevant and Appropriate Regulations (ARARs);
- ❑ Placing institutional controls on the property to limit future use of the Site and groundwater.

## 1.5 Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

For soil, the selected remedy does not meet the statutory preference for treatment, but the remedy will provide the greatest degree of long-term effectiveness, permanence and overall protection of human health and the environment. Additionally, excavated soil will be sampled onsite and treated through stabilization, if necessary, to render the soil a non-hazardous waste prior to disposal in a RCRA Subtitle D landfill. For groundwater, this remedy satisfies the statutory preference for treatment as a principal element of the remedy.

Because this remedy may result in hazardous substances, pollutants, or contaminants remaining onsite above residential levels, a review will be conducted every five years after construction completion at the Site to ensure that the remedy is, or will be, protective of human health and the environment.

## 1.6 Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision (Part 2). Additional information can be found in the Administrative Record file for this Site.

- ✔ *Chemicals of concern and their respective concentrations (p. 31)*
- ✔ *Baseline risk represented by the chemicals of concern (pp.37-38)*
- ✔ *Clean-up levels established for chemicals of concern and the basis for these levels (p.71)*
- ✔ *How source materials constituting principal threats are addressed(pp.62,71)*
- ✔ *Current and reasonably anticipated future land and groundwater use assumptions used in the Baseline Risk Assessment and ROD (p.30)*
- ✔ *Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy (p. 70)*
- ✔ *Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (pp. 68-69)*
- ✔ *Key factor(s) that led to selecting the remedy (i.e. describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision (p.63)*

## Authorizing Signature

Beverly H. Banister, Acting Director
Waste Management Division

9/28/06
Date

# PART 2: THE DECISION SUMMARY

## 2.1 Site Name, Location, and Brief Description

This Record of Decision (ROD) is for the Gurley Pesticide Burial Site (Site), which is located on East Preston Street in Selma, Johnston County, North Carolina. The coordinates for the Site on the Selma, North Carolina United States Geological Survey (USGS) survey are 35° 31' 49" north latitude and 78° 16' 45" west longitude. The Site is bounded to the west by East Preston Street/Gurley Road, the Seaboard Coastline Railroad right-of-way to the northwest, the Southern Railroad (Norfolk Southern) right-of-way to the northeast, and the Interstate 95 service road (Crocker Road) to the southeast (see Figure 1 for Site Location). The United States Environmental Protection Agency's (EPA) Site Identification Number is NCD986172526. The lead agency for this Site is the EPA. Site activities and actions have been conducted in compliance with the September 28, 1998, Administrative Order by Consent (Consent Order) No. 98-26-C between the Respondents (ExxonMobil and Illinois Cereal Mills) and EPA Region 4. The Site remediation is planned to be conducted using Responsible Parties' monies.

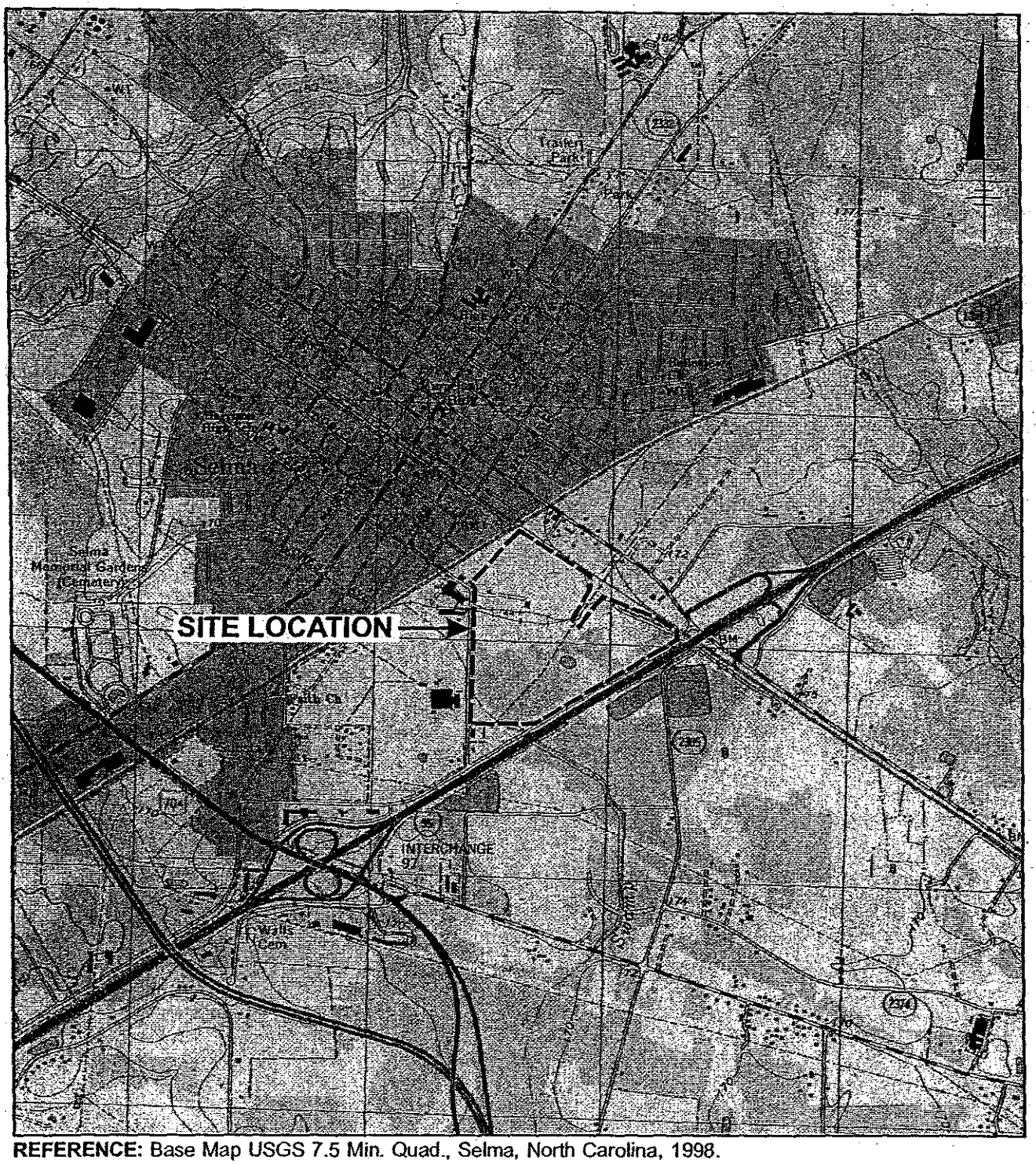
The Site, comprised of approximately 103 acres, is currently owned by NSEW Corporation and is the location of both a former phosphate fertilizer production facility and an agricultural chemical distribution facility. Virginia-Carolina Chemical Company began fertilizer manufacturing operations at the Site in the early 1900s and continued through 1963, when the facility was sold to the Socony (later Mobil) Oil Company. ExxonMobil is the corporate successor of Mobil. Operations ceased in 1969 at which time the Mobil Oil Company sold the property to Swift Agricultural Chemicals Corporation. In 1970, Swift sold the property to Gurley Milling Company, Inc. which subsequently transferred the property to Gurley, Inc. In 1982, Gurley, Inc. sold the property to G Co. Subsequently, Illinois Cereal Mills acquired the stock of Gurley, Inc. The NSEW Corporation acquired the property in May 2001.

There are two major areas of interest at the Site: the Pesticide Burial Area or PBA, and the Acid Plant Area or APA (see Figure 2 for Site Layout). The PBA is about 0.03 acres in size and is the former location of approximately 147 drums of pesticides that were buried by Gurley Milling Company in June 1974 and removed by Illinois Cereal Mills in December 1994/January 1995. The APA encompasses several subareas in the vicinity of the former fertilizer manufacturing plant. Historic discharges of acidic waters containing metals and spreading of debris and grain occurred in the APA. In addition, a third, smaller area between the railroad spurs that was the location of two 500-gallon underground storage tanks (USTs) is known as the UST Area.

## 2.2 Site History and Enforcement Activities

### 2.2.1 Activities that led to current problem

The PBA was created in 1974 after the State of North Carolina recommended disposal of DDT and organic chlorine pesticides in landfills consisting of piedmont tight clay. At that time,




**REFERENCE:** Base Map USGS 7.5 Min. Quad., Selma, North Carolina, 1998.

2000' 0 2000'

Approximate Scale: 1" = 2000'

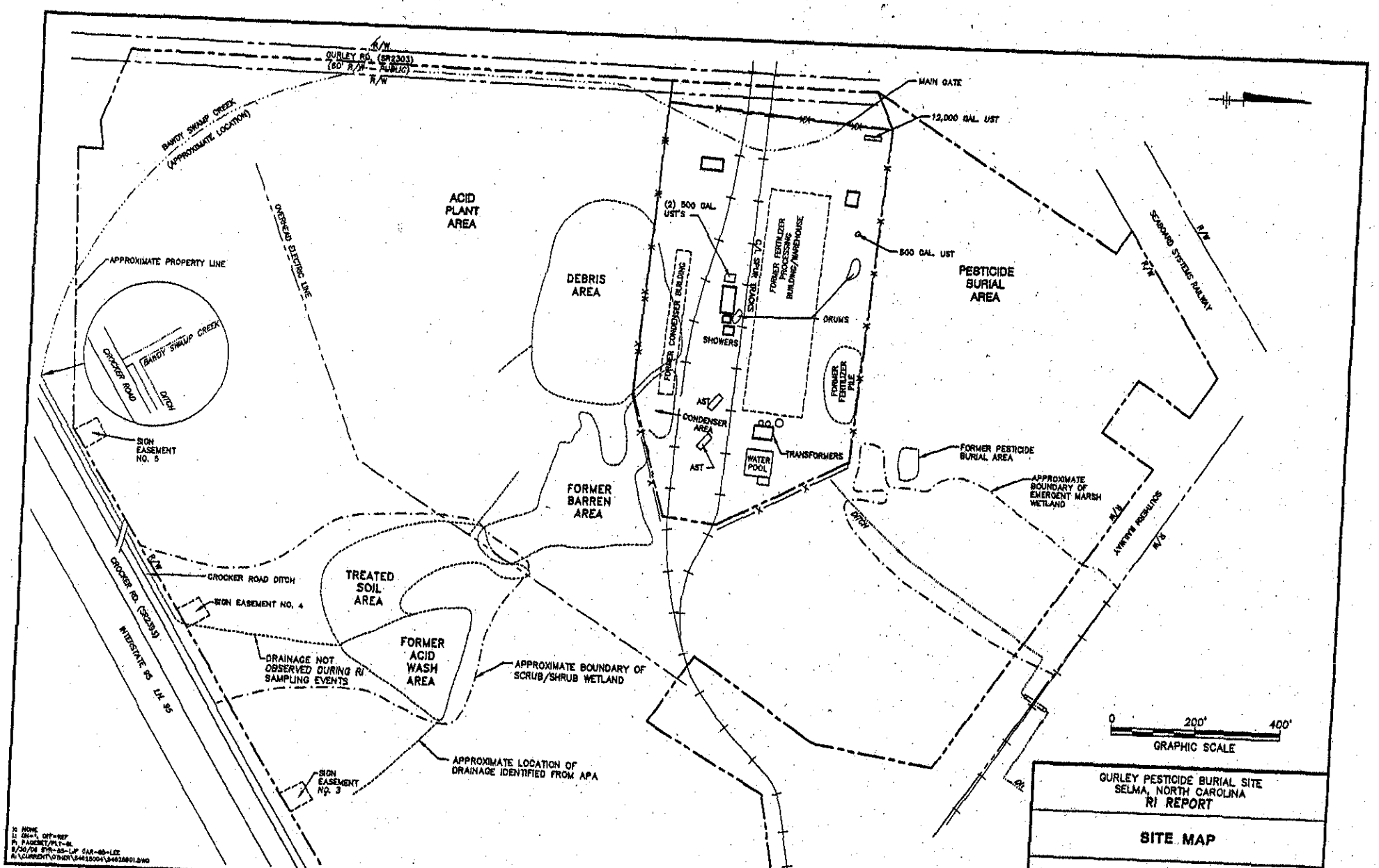
Area Location

GURLEY PESTICIDE BURIAL SITE
SELMA, NORTH CAROLINA

# SITE LOCATION MAP

FIGURE 1

08/30/06 SYR-D85-LBR OJH CAR-85-LEE
54625004/54625n01.cdr




GURLEY PESTICIDE BURIAL SITE
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RI REPORT

**SITE MAP**

FIGURE
**2**

these substances were banned by the EPA; however, there was no guidance concerning their disposal. In June of 1974, the Gurley Milling Company buried pesticides on the north side of its property (see Figure 2). The pesticide trench was approximately six feet deep and was lined with plastic. The trench was filled with powder product as well as 147 drums of pesticides and eventually backfilled with Site soil.

The APA contained a former phosphate/fertilizer manufacturing plant. Historic discharges of acidic waters containing metals and spreading of debris and grain occurred in the APA. In many phosphate/fertilizer manufacturing plants, ground-up phosphate rock and sulfuric acid were mixed in a reaction vessel to produce phosphoric acid, the building block for phosphate fertilizers. The resultant mixture was then held in a den area for solidification, and later transferred to a storage area for curing. The acid chambers used in the fertilizer production process represent the most relevant feature of phosphate/fertilizer operations. During periodic cleaning of the lead chambers, it is believed wash down water containing acid and soluble lead was flushed onto the ground surface.

Several small buildings are located in the UST area, the vicinity of the formerly active portion of the Site (the Facility). Portions of the foundations of a former condenser building and a former fertilizer processing building remain onsite.

### 2.2.2 Previous Investigations and CERCLA Actions

This section provides a summary of previous investigations and removal actions from 1990 to 2005.

#### 2.2.2.1 Preliminary Assessment, 1990

The North Carolina Department of Environment and Natural Resources (NCDENR, formerly NCDEHNR) completed a Preliminary Assessment (PA) report for the Facility in October 1990. The report states that several tons of pesticides from the "Gurmico Chemical Company" were buried in a 25-foot square, 6-foot deep trench. The pesticides were reportedly contained in bags and drums and included both liquids and solids. Analytical data that were derived from 7 samples collected at the fertilizer pile and in the Pesticide Burial Area (PBA) by NCDEHNR in October 1988 were included in the PA report.

The 1993 Site Inspection Prioritization report indicated that the PA samples were analyzed for pesticides, polychlorinated biphenyls (PCBs), semivolatile (extractable) organic compounds (SVOCs), volatile organic compounds (VOCs), metals, and pH. The primary analytes of interest (AOI) were DDT, DDE, DDD, ethyl parathion, and xylenes. Based on the results of the investigations, NCDEHNR recommended that a Site Screening Investigation be conducted in the near future.

#### 2.2.2.2 Site Investigation, 1991

NCDEHNR performed a Site Investigation at the Facility during March 1991 and issued a Site Investigation report on October 28, 1991, based on the Site Investigation sample analytical results and information included in the PA report.

These samples were reportedly analyzed for pesticides, PCBs, SVOCs, VOCs, metals, and pH. Lead and arsenic were the primary AOI detected in the Barren Area. Based on the available information and preliminary evaluations of exposure pathways, NCDEHNR concluded that: (a) a low-lying area associated with the PBA was impacted with organochlorine pesticides; (b) that a low-lying area associated with the APA (also known as the Fertilizer Process Area) was impacted with lead and arsenic and had low pH; and (c) that the surface water pathway was the predominant exposure pathway of concern.

2.2.2.3 Phase II Remedial Investigation, 1994

Conestoga Rovers & Associates (CRA) was contracted by Illinois Cereal Mills (ICM) to investigate impacts in the PBA and the APA. CRA performed their investigations during February, March, September, and October 1994. CRA's investigations of the PBA included a geophysical survey and sampling of sediment, surface soil, subsurface soil, and groundwater.

Sampling activities in the PBA included DDT field testing of 8 surface soil samples using a Millipore Envirogard field kit, surface soil and sediment sampling at 21 locations, collection of 25 subsurface soil sampling from 14 locations, and collection of 9 initial groundwater samples and two rounds of 5 subsequent groundwater samples. The surficial samples were analyzed for pesticides, and two samples were also analyzed for metals, sulfate, and pH. Subsurface soil samples were analyzed for VOCs and pesticides. The initial groundwater samples were analyzed for pesticides, metals, sulfate, and VOCs. Additional groundwater sampling (filtered and unfiltered) was conducted to evaluate previous detections of lead in unfiltered samples.

Based on the subsequent excavation activities, CRA concluded that the pesticide disposal pit was 40-feet by 60-feet by 7-feet deep. DDT, ethylbenzene, and xylenes were the principal AOI in the pit; nearby surface soil was impacted with DDD and DDT; and groundwater in the shallow aquifer in the vicinity of the pit was impacted with DDD, DDT, ethylbenzene, and xylenes. Lead detected in the unfiltered groundwater samples was shown to be due to the sampling methodology because silty samples contained lead and subsequently-collected un-silty samples did not contain lead. DDD, DDE, DDT, ethylbenzene, toxaphene, and xylenes were identified as the principal AOI in the area.

The CRA investigation of the APA included the following sub-areas:

- Lead Condenser Area
- Barren Area
- Acid Wash Area
- Debris Area portion of the APA
- Fertilizer Pile

- 12,000-gallon UST

Sampling activities included pH field testing of 45 surface water samples, surface water sampling at 2 locations, surface soil and sediment sampling at 30 locations, collection of subsurface soil samples from 26 borings, and collection of 23 groundwater samples from nine monitoring wells.

Elevated levels of lead and arsenic were detected at the surface in several sub-areas within the APA, including the Lead Condenser Area, Barren Area, Acid Wash Area, and the Debris Area. Lead, nitrate/nitrite, phosphorous, and sulfate were detected in the fertilizer pile, and no AOI were detected in subsurface soil at the UST.

Groundwater samples were collected from 6 shallow wells and 3 deep wells and were analyzed for VOCs, pesticides, metals, and sulfates. VOCs, elevated concentrations of lead, and sulfate were detected in the shallow groundwater samples, and sulfate was detected in the deep groundwater samples. In addition, VOCs were detected in the deep groundwater samples from 1 of the 2 sampling rounds. Although lead was also reported in the deep groundwater samples, the results were subsequently shown to be caused by the field preservation (in accordance with NCDEHNR recommended acid preservation protocols used at that time) of silty samples from the deep wells.

2.2.2.4 Removal Action, Pesticide Burial Area, 1994-1995

A Removal Plan was completed in June 1994 and submitted to NCDEHNR following completion of CRA's Phase II Remedial Investigations for the PBA. Removal actions were undertaken in December 1994 and January 1995.

The removal actions included removal of 147 drums and 898 cubic yards of soil from the pesticide disposal trench, confirmation sampling, and a post-excavation electromagnetic survey. The electromagnetic survey identified an anomaly southwest of the disposal trench; this was attributed to an abandoned water main buried in this area.

Surface soil samples for characterization and delineation were collected in the Pesticide Burial Area at 12 gridded locations and analyzed for pesticides. Three additional samples were taken in the vicinity of a known hot spot, and pre-excavation samples were also collected in the area of the rail staging area and loading area. Based on this sampling, DDD, DDE, DDT, and toxaphene were identified as the primary AOI.

During the removal activities, 56 confirmatory samples were collected and analyzed onsite for pesticides, and Target Compound List (TCL) VOC samples were sent offsite for analysis by a certified laboratory. Pesticide samples were collected on a 10-foot grid and VOC samples were collected on a 20-foot grid. Locations of confirmatory samples exceeding removal action clean-up criteria were re-excavated and re-tested until the clean-up criteria were met, with the exception of 6 surface soil samples collected outside the excavation area.

Samples of wastewater, waste materials, drummed waste, imported fill, and decontaminated equipment wipe samples and clean-up samples were also collected. A total of six samples were taken from surficial soil immediately beneath staging areas, and VOC and pesticide results indicated that no impacts had been spread to these areas.

2.2.2.5 Surface/Subsurface Soil Sampling, 1996

EPA collected 23 surface and subsurface soil samples during the week of August 15, 1996, to determine the extent of arsenic and lead impacts in the Barren Area. Six samples were collected from the Barren Area, eight samples were collected from the area surrounding the Barren Area, two were collected from the low-lying area downgradient of the Barren Area, one was collected from a ditch leading from the Facility, and the remaining samples were collected in the Condenser Area and Spur Area.

The samples were analyzed for metals, Toxicity Characteristic Leaching Procedure (TCLP) metals, and extractable polynuclear aromatic hydrocarbons (PAHs). Elevated concentrations of lead and arsenic were found in samples from the Barren Area, Condenser Area, and (Railroad) Spur Area. TCLP extract for lead was greater than 5 milligrams per liter (mg/L) in several samples from the Condenser and Spur Areas. Polynuclear aromatic hydrocarbons were detected in samples collected near the Spur Area.

2.2.2.6 Expanded Site Inspection, 1997

NCDEHNR completed an Expanded Site Inspection in June 1997. Sample results were based on sampling performed by NCDEHNR on October 18 and 19, 1994. All Expanded Site Inspection samples were analyzed for pesticides, extractable organics, volatile organics, and metals. NCDEHNR also split groundwater samples with CRA during their concurrent investigation of the Facility. No notable differences were observed in analytical results reported for the 10 split samples analyzed by NCDEHNR. A total of 36 samples for metals analyses were reportedly collected, including 10 of soil, 6 of surface water, and 20 of groundwater. A total of 35 samples for pesticide and PCB analysis were reportedly collected, including 10 of soil, 6 of surface water, and 19 of groundwater.

Based on pesticide and metal detections in all of the media tested, NCDEHNR concluded that one wetland area associated with the PBA was impacted with pesticides and a second wetland area associated with the APA was impacted with arsenic and lead. NCDEHNR also concluded that the surface water exposure pathway was the greatest concern at the Facility because of the bioaccumulation potential of the AOI.

In addition to these conclusions, NCDEHNR noted that surface drinking water was not a concern at the Facility and that no intakes existed downstream of the Facility within a 15-mile target distance. Also, NCDENR reported that there were no fisheries onsite and that downstream

impacts to fisheries were unlikely. In addition, NCDENR found that the soil exposure and air pathways were of minor concern at the Site due to the lack of receptors at that time.

2.2.2.7 Additional Field Investigations, 1997

On July 30, 1997, EPA collected four composite soil samples from near a mound of unidentified material (apparently the Fertilizer Pile), one grab sample from the mound of unidentified material, one grab sample from an above-ground storage tank (AST) containing oil, and one sample from the Debris Area portion of the APA. All samples were analyzed for extractable organic compounds, pesticides, PCBs, and metals. In addition, the AST oil was analyzed for TCLP metals, and all samples but the AST oil sample were analyzed for pH.

In all of the samples, pH was 4.4 or lower. Pesticides were detected in one composite sample from the (unidentified) mound and in the sample from the suspected disposal site in the Debris Area portion of the APA at low levels. Lead was detected above 1,000 milligrams per kilogram (mg/kg) in the AST oil sample and in the grab sample from the Debris Area portion of the APA.

2.2.2.8 Removal Action, Acid Plant Area, 1997

Removal actions at the APA were undertaken between May and October 1997. These activities were performed by Environmental Resources Management (ERM) for Mobil under an EPA Unilateral Administrative Order (UAO). Two to four feet of soil was excavated and removed from the Barren Area and Condenser Area, and replaced with clean fill. In the Spur Area, the upper foot of soil was excavated, and remaining soil to approximately 2 feet below original ground surface was treated by mixing with Portland cement. In the Acid Wash Area, soil was treated with hydrated lime.

Investigation and treatability study soil samples, confirmation soil samples, and waste disposal characterization soil samples were the primary categories of samples collected during this work. The 4 investigation and 21 treatability samples were analyzed for either total or TCLP metals and pH. A total of 18 confirmation samples, including one composite sample, were collected and analyzed for either total metals and pH (Barren and Condenser Areas) or TCLP metals and pH (Acid Wash and Spur Areas). A total of 25 disposal characterization soil samples were collected and analyzed for TCLP metals and pH.

Confirmation samples collected after the removal actions were completed indicated residual levels of arsenic, lead, and mercury in soil in the Barren Area and Condenser Area. However, concentrations were below the removal action clean-up criteria specified in the Removal Action Plan. Soil was removed from the designated areas if concentrations were above 400 mg/kg lead, 30 mg/kg arsenic, 2 mg/kg mercury, or pH greater than 3. The depths of soil excavation varied from 1 foot to 3.5 feet bgs.

The 1997 removal actions also included sampling and analysis of drum contents and transformer oil, and soil and groundwater sampling to support closure of two USTs north of the PBA (12,000-gallon and 500-gallon USTs) in accordance with NCDEHNR regulations. Nine drums were tested for waste characterization, including a full TCLP analysis on a composite sample that resulted in a non-hazardous determination. The transformers and drums were removed from the Facility.

ERM also drummed the contents of an AST and associated materials, although no sampling specific to the AST was required.

2.2.2.9 Removal Action, 1998

The July 13, 1998 final EPA Pollution Report (POLREP) for the Facility documented the testing and disposal of waste contained in roll offs and drums and removed from the Facility by EPA's contractor in 1998. As part of this action, lime/fertilizer materials were stockpiled, 40 cubic yards of impacted soil were removed from the Debris Area portion of the APA, two 500-gallon USTs were removed from the Spur Area west of the showers, and soil and petroleum products associated with one of the USTs and the stockpile were disposed of by EPA's contractor.

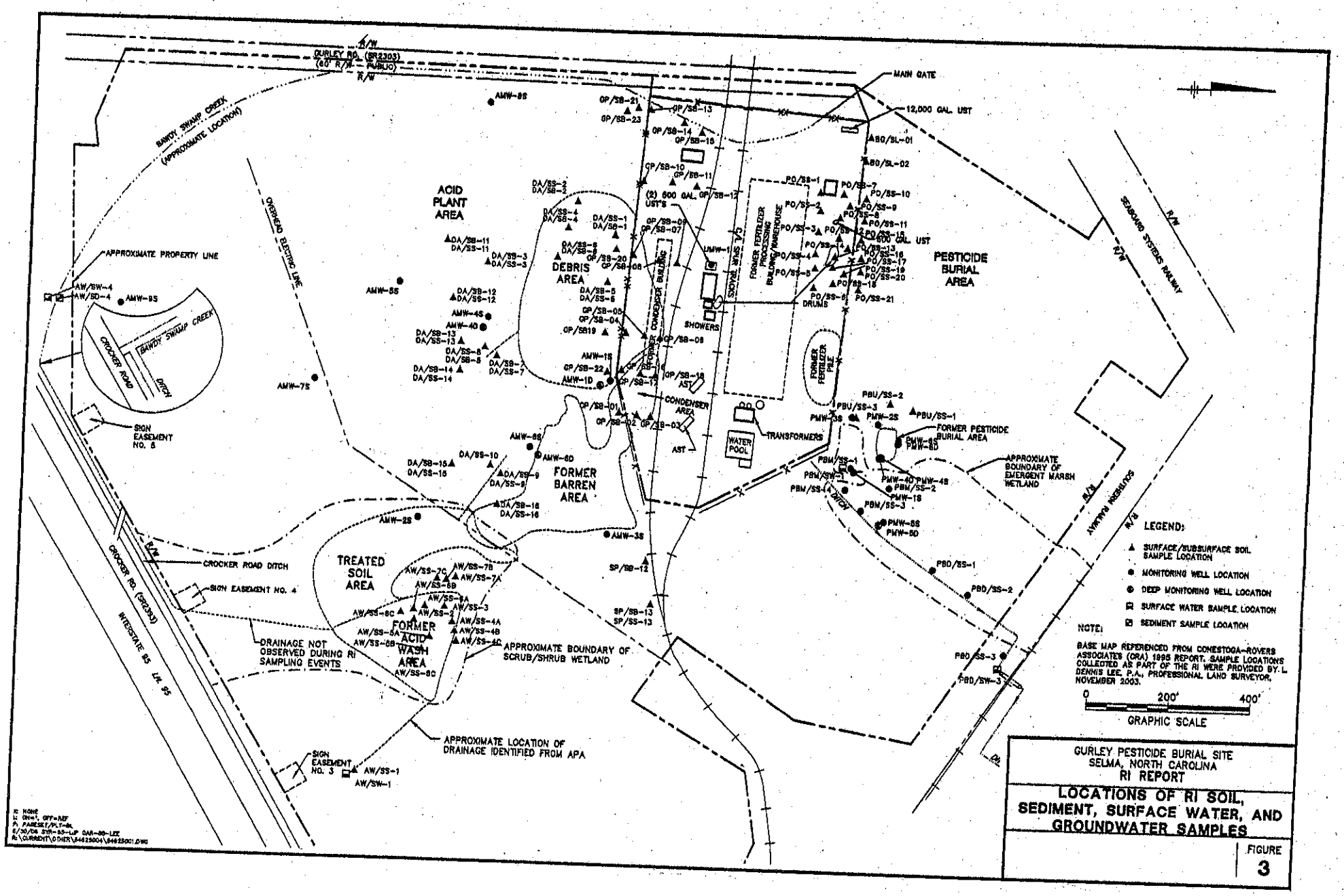
A total of 32 drums of wastes and 32 twenty cubic yard roll-off containers of waste were removed from the Site. Twenty six drums contained leaded gasoline and other materials associated with the removal of one of the 500-gallon gasoline USTs, and 6 drums contained clean-out sludge from an AST located between two railroad spurs. Twenty five of the 32 roll-offs contained material from the fertilizer pile, 5 contained impacted soil from the USTs, and 2 contained material from the Debris Area portion of the APA.

2.2.2.10 Groundwater Sampling, 1998

URG Greiner Woodward Clyde (URSGWC) collected groundwater samples from all existing onsite wells in December 1998. The validated analytical data were submitted to EPA in March 1999. The sampling results demonstrated that no AOI were detected in any of the deep wells. The results also demonstrated that AOI were detected in only a minority of the shallow wells and in low concentrations. URSGWC concluded that, based on the sampling data, there was a significant improvement in groundwater quality at the Site since the previous sampling event, which was conducted in 1994. The improvement was likely due to the removal of some of the source material, natural attenuation, and improved sample collection and analysis procedures.

2.2.2.11 Remedial Investigation, 2003-2005

Samples of soil, groundwater, surface water, and sediment were collected and analyzed to provide data for the Remedial Investigation (RI) at the Site in October and November 2003 and March and May 2004 (see Figure 3 for RI Sampling Locations). In addition, temporary




GURLEY PESTICIDE BURIAL SITE
SELMA, NORTH CAROLINA
RI REPORT

# LOCATIONS OF RI SOIL, SEDIMENT, SURFACE WATER, AND GROUNDWATER SAMPLES

FIGURE
3

piezometers and surface water elevation gauges were installed and groundwater and surface water elevations were measured. A geophysical survey was performed for a portion of the PBA. The purpose of the RI was to characterize the extent of contamination and to assess potential contaminant migration pathways. The results confirmed contamination present in several areas of the Site. Results are presented in the Site Characteristics Section of this document.

### 2.2.3 Enforcement Activities

In April 1997, EPA issued a Unilateral Administrative Order (UAO) for Removal Action that resulted in a Removal Action conducted by Mobil Oil Corporation in 1997. In September 1998, EPA entered an Administrative Order by Consent (Consent Order) with Mobil Oil Corporation and Illinois Cereal Mills (Respondents). The Respondents agreed to all terms and conditions of the Consent Order to conduct and implement the Remedial Investigation and Feasibility Study (RI/FS). In May 2001, NSEW, the current owner of the Site (Respondent) entered into a Prospective Purchaser Agreement (PPA) with EPA, whereby the Respondent agreed to reimburse EPA a portion of its response costs incurred at the Site. EPA published a Notice of Proposed Settlement in the Federal Register on May 1, 2001, announcing the PPA and a thirty day comment period.

## 2.3 Community Participation

In September 1997, the first Fact Sheet was distributed to the community, discussing the Site Inspection, Expanded Site Inspection, Removal Investigation and Removal Action. A Community Involvement Plan was prepared in May 1999. Another Fact Sheet was distributed to the community in March 2000, providing information on the activities that had already occurred on the Site and future activities in the Superfund process. A "Kick Off" Public Meeting was also conducted in Selma, NC in April 2000.

The Proposed Plan Fact Sheet was mailed to the community on July 24, 2006. The Administrative Record file was made available to the public on July 28, 2006. It was placed in the information repository maintained at the EPA Region 4 Superfund Record Center in Atlanta, Georgia, and at the Selma Public Library. The notice of the availability of the Administrative Record and an announcement of the Proposed Plan public meeting was published in the Smithfield Herald newspaper on July 28, 2006. A public comment period was held from July 31, 2006 to August 29, 2006. The Proposed Plan was presented to the community in a public meeting on August 9, 2006 at the Town of Selma Courthouse. At this meeting, representatives from EPA answered questions about contamination at the Site and the remedial alternatives. There were no written comments received from the public. Verbal comments from the public meeting are noted in the Responsiveness Summary, located in Part 3 of this ROD.

## 2.4 Scope and Role of Operable Unit or Response Action

EPA has chosen to use only one Operable Unit for this Site. The remedy will address soil and groundwater contaminated with elevated levels of lead, arsenic, and fluoride. The removal

of the soil and treatment of the groundwater are explained in Section 2.12 of this ROD. This action will reduce the risks to human and ecological receptors.

The remedy will include institutional controls to limit future use of the Site, prevent future residential use of the Site and restrict groundwater use. Confirmation sampling results after the clean-up is complete will be reviewed to determine if restrictions against residential use are still necessary.

## 2.5 Site Characteristics

### 2.5.1 Conceptual Site Models

The Conceptual Site Model developed in the Human Health Risk Assessment (HHRA) is presented in Table 1 (the same model applies to the PBA). The Conceptual Site Model developed in the Ecological Risk Assessment (ERA) is explained following Table 1.

Table 1
Conceptual Site Model (Human Receptors)

| Source | Receptor | Exposure Media | Exposure Route |
|---|---|---|---|
| Acid Plant Area | Current Trespasser | Surface Soil | Dermal Contact |
| | | | Ingestion |
| | | | Inhalation |
| | | Surface Water | Dermal Contact |
| | | | Ingestion |
| | | Sediment | Dermal Contact |
| | | | Ingestion |
| | Future Industrial Worker | Subsurface Soil | Dermal Contact |
| | | | Ingestion |
| | | | Inhalation |
| | | Surface Soil | Dermal Contact |
| | | | Ingestion |
| | | | Inhalation |
| | | Surface Water | Dermal Contact |
| | | | Ingestion |
| | | Sediment | Dermal Contact |
| | | | Ingestion |
| | Future Construction Worker | Subsurface Soil | Dermal Contact |
| | | | Ingestion |
| | | | Inhalation |

| | | | |
|---|---|---|---|
| | | Surface Soil | Dermal Contact |
| | | | Ingestion |
| | | | Inhalation |
| | | Surface Water | Dermal Contact |
| | | | Ingestion |
| | | Sediment | Dermal Contact |
| | | | Ingestion |
| | | Groundwater | Dermal Contact |
| | | | Ingestion |
| | | | Inhalation |
| | Current/Future Offsite Resident | Fish | Ingestion |
| | | Groundwater | Dermal Contact |
| | | | Ingestion |
| | | | Inhalation |

Conceptual Site Model (Ecological Receptors)

The Contaminants of Potential Concern (COPC) for the PBA are DDT (and metabolites DDD and DDE), endrin (including endrin aldehyde and endrin ketone), and toxaphene. The COPCs for the APA are arsenic, lead, and mercury. The ecological receptors potentially at risk in the PBA include those species associated with the upland forested areas, marsh, and ditch. The ecological receptors potentially at risk in the APA include those species associated with the old field and forested habitats of the Debris Area, the Former Barren Area, the Former Acid Wash Area, Crocker Road ditch, and Bawdy Swamp Creek. Complete exposure pathways for soil/sediment invertebrates in the PBA and APA are direct contact with surface soil, sediment, and surface water. Complete exposure pathways for avian and mammalian receptors in the PBA and APA are incidental ingestion of soil/sediment and ingestion of contaminated prey.

### 2.5.2 Site Overview

The Site, which is currently owned by NSEW Corporation, is the location of both a former phosphate fertilizer production facility and a former agricultural chemical distribution facility and is located on East Preston Street in Selma, Johnston County, North Carolina. Coordinates for the Site on the Selma, North Carolina USGS quadrangle, are 35°, 31', 49" north latitude and 78°, 16', 45" west longitude. The Site consists of approximately 103 acres of land bounded to the west by East Preston Street/Gurley Road, the Seaboard Coastline Railroad right-of-way to the northwest, the Southern Railroad (Norfolk Southern) right-of-way to the northeast, and the Interstate 95 service road Crocker Road to the southeast (see Figure 1).

### 2.5.3 Surface and Subsurface Features

There are two major areas of interest at the Site, designated the Pesticide Burial Area (PBA) and the Acid Plant Area (APA). The PBA is the former location of approximately 147 drums of pesticides that were buried by Gurley Milling Company in June 1974, while the APA encompasses several subareas in the vicinity of a former phosphate fertilizer manufacturing plant. Historic discharges of acidic waters containing metals and spreading of debris and grain occurred in the APA. In addition, a third, smaller area between the railroad spurs was the location of two 500-gallon underground storage tanks (UST Area). Of those, only the Acid Plan Area was determined to contain concentrations of chemicals above the clean-up goals established in later sections of this ROD.

There are two separate surface water drainage directions onsite, divided in the vicinity of the east-west railroad spur that roughly bisects the Facility (Railroad Spur Area). The PBA is located in one of these drainage areas and the APA is located in the other.

Surface water in the PBA drains into a ditch that flows toward the northeast. According to NCDENR, after reaching the ditch, water from the PBA flows through the associated low-lying areas and a small pond within them. Water from the low-lying areas and pond flow northward to a railroad ditch that drains toward the east into an intermittent stream. The intermittent stream flows toward the southeast and joins Moccasin Creek approximately one mile downstream of the PBA. Moccasin Creek flows approximately 6.5 miles toward the southeast into Holts Pond.

Surface water in the APA drains into a ditch along Crocker Road that flows to the southeast toward Bawdy Swamp Creek. According to NCDENR, water from the APA flows approximately 1,100 feet southeastward from the APA across low-lying areas to the Crocker Road Ditch (see Figure 2). Bawdy Swamp Creek then reportedly becomes a low-lying area approximately 500 feet downstream, continues toward the south-southeast, and becomes perennial approximately 1.5 miles downstream. Bawdy Swamp Creek enters the Neuse River approximately 12.5 miles farther downstream, or roughly 14 miles downstream and southeast of the APA.

The Site is located along the western edge of the Coastal Plain Physiographic region. The Geologic Map of North Carolina indicates that the Facility is located within one mile north of the division between areas underlain by Coastal Plain Terrace Deposits and Upland Sediment (to the northwest) and the Yorktown and Duplin Formations (to the southeast). The terrace deposits and upland sediment are composed of gravel, clayey sand, and sand with minor amounts of iron-cemented sandstone. The Yorktown Formation is usually encountered on the northern side of the Neuse River and is composed of fossiliferous clay with varying amounts of fine-grained sand, and shell material often concentrated in lenses. The Duplin Formation is usually encountered in areas south of the Neuse River and is composed of shelly, medium- to coarse-grained sand, sandy marl, and limestone.

The Site is underlain by Coastal Plain Deposits that are divided into two distinct stratigraphic units beneath the property. The upper unit is a silty clay with occasional sand lenses that vary from zero to 14 feet (below ground surface) bgs in the PBA and between zero and 17.5 feet bgs in the APA. The lower unit is predominantly composed of saturated, medium- to coarse-grained sands that vary from approximately 18 feet thick in the PBA to 17 to 25 feet thick in the APA. The Coastal Plain Deposits are underlain onsite by a soft, friable fine-grained saprolytic (weathered) phyllite of the Eastern Slate Belt that was encountered from approximately 34 to 40 feet bgs and extended to approximately 80 feet bgs. A saprolytic granodiorite was encountered beneath the saprolytic phyllite at approximately 80 feet bgs that was underlain by competent rock at approximately 100 feet bgs.

Three hydrologic units have been identified at the Site, including an upper clay unit that is believed to serve as an aquitard; an immediately underlying aquifer in the Coastal Plain sands; and a second aquifer in the upper, weathered or fractured portion of the bedrock that underlies the surficial aquifer (Upper Bedrock Aquifer). The upper clay aquitard is approximately 14 feet thick in the PBA, APA, and UST Area. The Coastal Plain sands are likely confined or partially confined by the immediately overlying clay aquitard, as evidenced by water level, and averages approximately 18 to 21 feet in thickness at the Site. It is in turn immediately underlain by the Upper Bedrock Aquifer, that extends from the base of the Coastal Plain sands to the top of competent rock, which is located roughly 100 feet bgs.

Water level observations for the surficial aquifer vary from approximately 0.87 feet bgs in monitoring well PMW-5S to 4.63 feet bgs in monitoring well AMW-1S. Water level observations in the Upper Bedrock Aquifer vary between 0.91 feet bgs in monitoring well PMW-4D to 4.46 feet bgs in monitoring well AMW-4D. Groundwater elevations were measured during the groundwater sampling event. Data from 14 shallow and 5 deep groundwater monitoring wells at the Site were used to support the development of groundwater potentiometric surface maps. Groundwater flows to south/southwest in both the shallow and deeper groundwater at the Site.

Based on groundwater elevations calculated from the available water level observations, calculated horizontal hydraulic gradients in the surficial aquifer vary between 0.0033 feet per foot (ft/ft) in the western portion of the property to 0.001 ft/ft in the southern portion of the property. In the Upper Bedrock Aquifer the approximate horizontal hydraulic gradient is 0.0001 ft/ft.

Vertical gradients were calculated for the deep and shallow well pairings based on groundwater elevation data from the January 13, 2005 sampling event. In the APA vertical gradients varied from 0.0019 ft/ft in the downward direction at well pairing AMW-6S/6D to 0.0062 ft/ft in the upward direction at well pairing AMW-4S/4D. In the PBA vertical gradients varied from 0.0079 ft/ft in the downward direction at well pairing PMW-5S/5D to 0.0182 ft/ft in the upward direction at well pairing PMW-6S/6D.

The Site is discontinuous in its hydrogeology with some areas recharging surface bodies of water and run-off, while other areas have relatively no movement in the subsurface aquifer.

Rising head slug tests were performed on selected shallow groundwater monitoring wells. The Bouwer-Rice solution was used to calculate the hydraulic conductivity in the vicinity of each well. Hydraulic conductivities calculated for the wells varied from 1.76 feet per day (ft/day) at UMW-1 to 22.88 ft/day at AMW-7S.

### 2.5.4 Sampling Strategy

Previous sampling data is referenced and/or included in the EPA approved RI/FS workplan. Samples collected during the Preliminary Assessment, Site Investigation, and Expanded Site Inspection were analyzed for pesticides, volatile and extractable organics, and metals. The samples were collected from various media in the PBA and/or APA. The results indicated that the PBA was impacted by pesticides and the APA was impacted by lead, arsenic, and low pH. Some VOC impacts were noted in sampling from former fuel storage areas. As noted in previous sections, the PBA area was addressed and fuel storage tanks were properly closed out during previous removal actions. Portions of the APA were also addressed during previous removals.

Samples of soil, groundwater, surface water, and sediment were collected and analyzed to provide data for the RI at the Site. In the APA, 87 soil samples were collected and analyzed for metals. Due to historical data and findings, it was determined unnecessary during the RI to analyze soil samples from the APA for PCBs, VOCs, SVOCs or pesticides. In the PBA, 35 soil samples were collected and analyzed for pesticides and PCBs. Due to historical data and findings, it was determined unnecessary during the RI to analyze soil samples from the PBA for metals or VOCs. In all, 22 groundwater samples were collected from the Site. Two sediment samples were collected in the APA, seven sediment samples were collected in the PBA, and two sediment samples were collected from background locations. Two surface water samples were collected in the APA, four surface water samples were collected in the PBA, and two surface water samples were collected from background locations.

Ecological data and biological tissue samples were collected to support the ecological risk assessment. The biological tissue sampling included the collection of small mammals, soil invertebrates, and frogs from the PBA, APA, and a reference location. Samples collected from the PBA were analyzed for TCL pesticides while the samples from the APA were analyzed for target analyte list (TAL) metals. Samples from the reference area were analyzed for both TCL pesticides and TAL metals.

### 2.5.5 Known and/or Suspected Sources of Contamination

Suspected sources of contamination include the former burial of pesticides in the PBA and acidic discharges containing metals in the APA from the phosphate fertilizer manufacturing process.

## 2.5.6 Types of Contamination and Affected Media

### 2.5.6.1 Acid Plant Area

#### 2.5.6.1.1 Soil

Between 1990 and 2005, a total of 71 surface soil samples were collected from the APA and analyzed for metals; 43 of these surface soil samples were collected during the RI. Surface soil was considered to be the upper six inches of soil. An evaluation of this complete data set indicates that arsenic concentrations varied from not detected in 9 samples to 300 mg/kg in 1 sample. The average arsenic concentration in surface soil was 18.1 mg/kg. Lead concentrations varied from not detected in 1 sample to 36,000 mg/kg in 1 sample. The average lead concentration in surface soil was 3120 mg/kg.

Twenty-eight surface soil samples had arsenic concentrations above both screening levels, the reference concentration, and the NCDENR Soil Remediation Goals (SRGs), while 27 surface soil samples had lead concentrations above both screening values. Chromium was the only other metal detected above the NCDENR SRG. Chromium was detected in one sample at a concentration of 31 mg/kg, which is slightly above the NCDENR SRG (30 mg/kg). This sample also contains elevated lead and arsenic concentrations. Nine surface soil samples collected from the APA were analyzed for TCLP metals and all results were less than the regulatory levels. The pH of the surface soil samples collected from the APA is low and varies between 2.2 and 5.0.

Between 1990 and 2005, a total of 54 subsurface soil samples were collected from the APA and analyzed for arsenic, lead, and mercury; 45 of these subsurface soil samples were collected during the RI. Subsurface soil samples were collected to a maximum depth of four feet bls. An evaluation of this data set indicates that arsenic and lead were detected in subsurface soil samples collected from the APA at concentrations greater than the screening levels. Arsenic concentrations varied from not detected in eight samples to 310 mg/kg in 1 sample. The average concentration of arsenic in soil collected from 0-4 bls was 21.3 mg/kg. Lead concentrations varied from not detected in 3 samples to 23,000 mg/kg in 1 subsurface soil sample. The average concentration of lead in soil collected from 0-4 bls was 1920 mg/kg.

Thirteen samples had arsenic concentrations above the screening levels and six samples had lead concentrations above the screening levels. Mercury did not exceed the screening levels in any of the subsurface soil samples collected during the RI. The pH of the subsurface soil samples collected from the APA varies between 3.0 and 6.3. Sulfate concentrations collected from the Debris Area during the RI vary between 450 mg/kg in the sample collected from DA/SB-5 and 1,400 mg/kg from the sample collected from DA/SB-2. Sulfate concentrations of all samples collected vary between 160 mg/kg in the sample collected from location MWA4 and 20,000 mg/kg from the sample collected from A34.

Samples were collected from the Acid Wash Area to determine if additional pH adjustment of soil was needed (hydrated lime had been applied to this area as part of the 1997 removal action). The pH of the soil samples varies from 4.2 to 5.0. In addition, CEC values vary between 5.3 and 9.1 meq/100g. It does not appear that additional pH adjustment in the acid wash area is necessary at this time.

2.5.6.1.2 Sediment

Sediment samples were collected by NCDENR at the Site in 1994 and 1996; additional samples were collected during the RI. Metals were present in one or more of the sediment samples. Five metals were detected in the previous sediment samples collected from the APA at concentrations above both screening levels, the reference concentrations and the EPA Region 4 screening levels, including arsenic, copper, lead, mercury, and zinc. Arsenic concentrations varied from not detected to 190 mg/kg in 1 sample. Lead concentrations varied from 16 mg/kg to 870 mg/kg. The sediment samples with copper, mercury, and zinc at elevated concentrations are present only in samples with elevated arsenic and/or lead concentrations. The pH of sediment samples collected from the APA varies from 4.2 to 6.6.

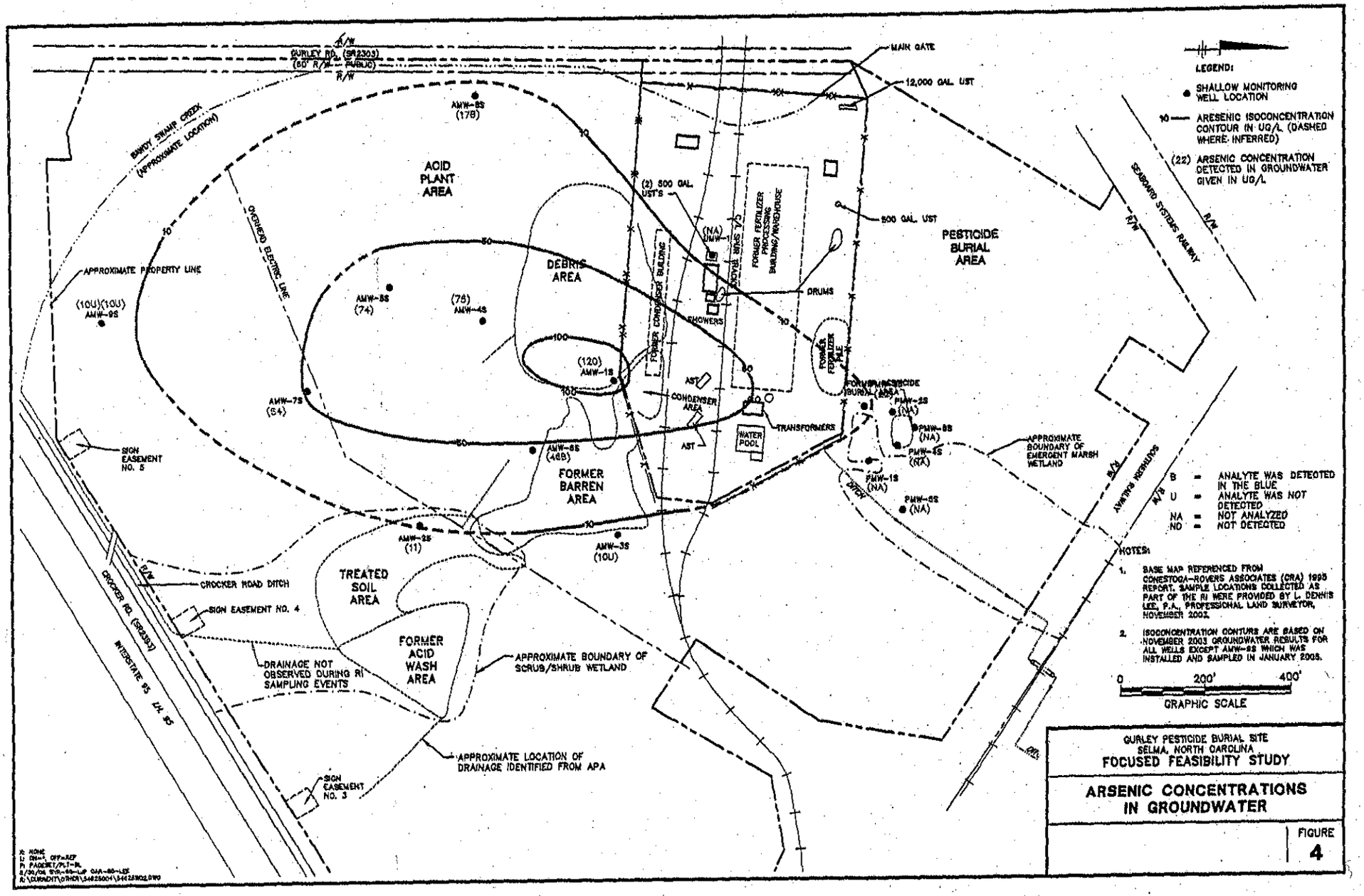
Low concentrations of three pesticides, 4,4'-DDD, 4,4'-DDT, and dieldrin, were detected in 1 sample. Detected pesticide concentrations were greater than both the reference concentration and the EPA Region 4 sediment screening levels. Sulfate concentrations vary between 92 mg/kg and 3,600 mg/kg in the sample collected from A09. No PCBs or VOCs were detected in any of the sediment samples from prior investigations.

2.5.6.1.3 Groundwater

Historical data indicate groundwater impacts of arsenic, lead, and VOCs in the APA. Groundwater samples were collected in the APA to provide current data for groundwater quality characterization and to evaluate potential impacts on downgradient receptors and surface water.

During the RI sampling events, samples were collected and analyzed for arsenic, lead, and mercury. Arsenic and lead were detected in groundwater samples collected from the shallow monitoring wells in the APA at concentrations greater than the screening levels. Groundwater concentrations were screened against NCDENR's Groundwater Quality Standards (NCDENR 2L Standards). Arsenic concentrations varied from not detected in 5 samples to 120 micrograms per liter ($\mu$g/L). Lead concentrations varied from not detected to 380 $\mu$g/L. Arsenic, lead, and mercury were not detected in any of the three deep APA groundwater monitoring wells, indicating that deep groundwater is not impacted. See Figures 4 and 5 for the approximate extent of arsenic and lead contamination in the shallow groundwater.

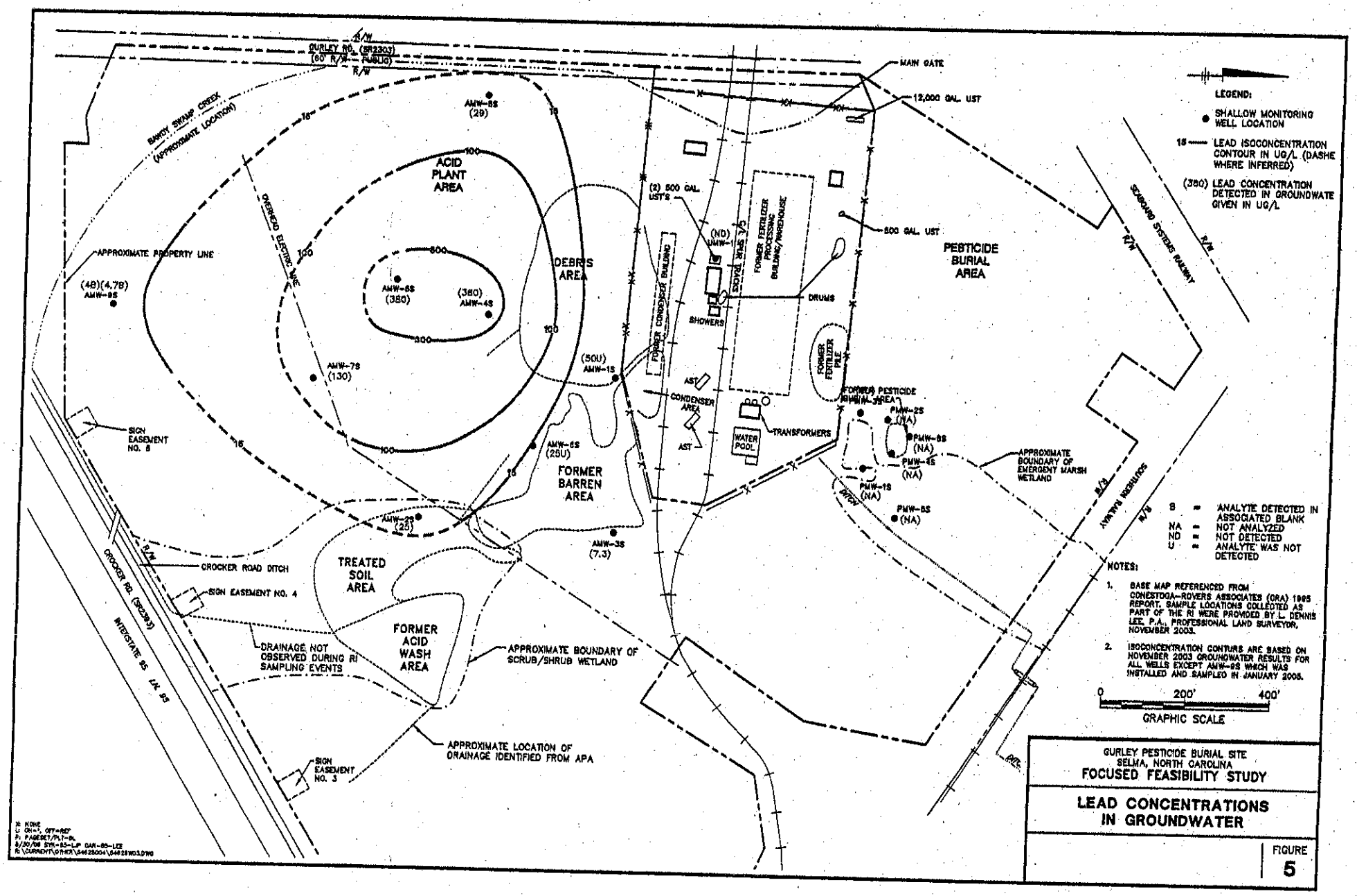
Historically, two VOCs (1,2-dichloropropane and benzene), have been detected in groundwater samples collected from the monitoring wells in the APA. During the RI




GURLEY PESTICIDE BURIAL SITE
SELMA, NORTH CAROLINA
FOCUSED FEASIBILITY STUDY

## ARSENIC CONCENTRATIONS IN GROUNDWATER

FIGURE
4




GURLEY PESTICIDE BURIAL SITE
SELMA, NORTH CAROLINA
FOCUSED FEASIBILITY STUDY

**LEAD CONCENTRATIONS IN GROUNDWATER**

FIGURE **5**

groundwater sampling event, 1,2-dichloropropane and benzene were detected at concentrations above the screening levels. Benzene was detected in a sample at a concentration of 65 µg/L, which is greater than the screening level of 1 µg/L. 1,2-Dichloropropane was detected in well AMW-6S at a concentration of 7.4 µg/L, which is greater than the screening level of 0.56 µg/L.

Groundwater samples collected during the RI were analyzed for fluoride. Fluoride was detected above the screening level of 2 mg/L in the samples collected from 2 monitoring wells. Fluoride concentrations varied between not detected in 4 wells to 170 mg/L. Groundwater samples collected during the RI were also analyzed for sulfate. Sulfate was detected above the screening level of 250 mg/L. Sulfate concentrations varied between 86 and 5,300 mg/L, the concentration in the groundwater sample collected from monitoring well AMW-4S. The pH of the shallow wells are low and vary from 3.29 in monitoring well AMW-1S to 4.71 in monitoring well AMW-2S.

2.5.6.1.4 Surface Water

Surface water samples were collected in the APA to evaluate potential impacts of surface water runoff and the discharge of shallow groundwater on the quality of surface water leaving the Site. In addition, the surface water samples were collected to estimate the flow and concentrations of impacted surface water in the ditch during low and high flow events for use in risk assessment and for predicting offsite impacts to surface water.

Historically, arsenic and lead have been detected in most surface water samples collected. A total of 7 surface water samples have been collected from the APA and analyzed for metals; 2 of these surface water samples were collected during the RI. Arsenic concentrations in prior surface water samples varied from not detected to 220 µg/L (estimated). Lead concentrations in the pre-RI surface water samples varied from not detected to 2,500 µg/L (estimated). Several other metals, including aluminum, copper, and zinc, were present in the surface water samples at concentrations greater than the selected screening levels and are co-located with elevated arsenic and lead concentrations. The surface water data screening levels were selected from the lesser of NCDENR's Surface Water Standards and EPA's Region 4 ecological freshwater surface water screening values. Surface water data were also screened against the reference concentrations.

Arsenic was not detected in the RI surface water samples. Lead was detected in the RI surface water samples at concentrations between 34-45 µg/L.

Historically, sulfate has been detected in surface water samples collected from the APA and pH has been relatively low. The sulfate concentrations in the surface water samples collected during the RI were 110 mg/L (170 mg/L detected in the duplicate) and 39 mg/L, respectively, which are greater than the reference concentration but less than the selected screening level.

The fluoride concentration in the RI surface water samples varied from not detected to 5.7 mg/L (7.7 mg/L detected in the duplicate), which is greater than both the reference

concentration and the selected screening level. Finally, the pH of the surface water samples collected during the RI varied from 3.74 to 4.84.

Historically, no VOCs, PCBs, or pesticides were detected in any of the surface water samples collected from the APA.

Based on the concentrations of arsenic and lead in the surface water samples, it appears that shallow groundwater does not significantly impact the quality of the surface water in this area of the Site. Concentrations of arsenic and lead collected from the drainage during the high flow event in 2004 was less than the reference concentration but greater than the selected screening levels and will be used as the estimate of concentrations of surface water in the drainage. In addition, the absence of arsenic and very low concentration of lead in the groundwater sample from well MW-9S located near Bawdy Swamp Creek suggests that groundwater may not be the source of the lead in Bawdy Swamp Creek at that particular location. However, arsenic and lead are found at slightly higher concentrations in MW-8S which is adjacent to Bawdy Swamp Creek and which is upstream of the MW-9S.

2.5.6.2 Pesticide Burial Area

2.5.6.2.1 Soil

Between 1990 and 2003, NCDENR, CRA, EPA, Environmental Resources Management, URSGWC, and BBL collected soil samples at the Site. Pesticides were present in one or more of the surface and/or subsurface soil samples. Of the detected pesticides, DDD and DDT are generally present in Site soil at elevated concentrations and widespread distributions.

Pesticides have historically been detected in samples collected from the PBA. Five pesticides (4,4'-DDD, 4,4'-DDT, dieldrin, lindane, and toxaphene) have been detected at concentrations above both screening levels, the reference concentration and the SRGs. Both screening levels for 4,4'-DDD and 4,4'-DDT were exceeded 18 and 19 times, respectively. Dieldrin was detected in one sample at a concentration of 0.25 mg/kg (estimated) above both screening levels while lindane was also detected in one sample at a concentration of 1.8 mg/kg above both screening levels. Toxaphene was detected in 14 samples above both screening levels.

Twenty-seven soil samples (21 discrete samples and 6 composites of those 21 discrete samples) were collected during the RI in the Pesticide Odor Area and analyzed for pesticides. Nine pesticides were detected at levels greater than the reference concentrations; however, dieldrin was the only pesticide detected in a sample from the Pesticide Odor Area at a concentration that exceeded both the reference concentration and the SRGs. The dieldrin concentration in sample PO/SS-11 was 0.06 mg/kg (estimated), which is slightly higher than the SRG of 0.03 mg/kg. Pesticides in all other samples collected from the Pesticide Odor Area were less than screening levels or not detected.

The pH of the surface soil samples collected from the upland area, ditch, and marsh in the PBA during the RI varied between 3.8 and 5.2. Historical pH values from the four analyzed samples average 3.8. Sulfate concentrations measured at the PBA during the RI vary between 100 mg/kg in the sample collected from location PBU/SS-2 and 2,100 mg/kg in the sample collected from location PBD/SS-1 while Total Organic Carbon (TOC) levels vary from 11,000 mg/kg in sample PBM/SS-4 to 110,000 mg/kg in the sample collected from location PBD/SS-2. TCLP analyses on two surface soil samples were analyzed for the 8 RCRA metals. Metals were not detected in the leachate from these two samples.

Historically, PCBs were not detected in the surface soil samples collected from the PBA. Eight samples collected during the RI from the PBA were analyzed for PCBs, but PCBs were not detected in those samples.

Only one pesticide, 4,4'-DDT, was detected in the subsurface soil samples. The subsurface soil sample collected from location MWP3 detected 4,4'-DDT at a concentration of 0.023 mg/kg, which is less than the SRG of 1.7 mg/kg but greater than the reference concentration of 0.012 mg/kg. Pesticides were not detected in the other subsurface soil samples analyzed at the Site.

Historically, PCBs were not detected in the four subsurface soil samples collected from the PBA.

Based on the concentrations of pesticides in the soil samples collected from the PBA, pesticide-impacted soil is limited to the vicinity of the former Pesticide Burial Area and one historical sample collected from within the ditch. Screening levels were not exceeded in any of the subsurface soil samples collected from the PBA.

2.5.6.2.2 Sediment

NCDENR and CRA collected sediment samples at the Site in 1994 and 1995. Pesticides were present in one or more of the sediment samples. Of the detected pesticides, 4,4'-DDD and 4,4'-DDT were the two typically detected at the highest concentrations.

Sediment samples were collected during the RI from the ditch (PBD/SS-1 through -3) to evaluate analyte migration potential and downstream ecological exposure. Sediment samples were also collected from the low-lying areas of the PBA (PBM/SS-1 through -4) to determine representative concentrations of impacted sediment to be used in the ecological and human health exposure assessments.

As earlier described, samples collected during the RI sampling event from the marsh (PBM/SS-1) and drainage ditch (PBD/SS-3) have been designated as sediment samples only because of the presence of water at these sample locations. The remaining samples collected from the marsh and drainage ditch have been designated as both surface soil and sediment samples due to the absence of standing water and are included in the discussions of both surface

soil and sediment. Historical samples (pre-RI) collected in low-lying areas of the Site (see Table 2-2) have been designated as both surface soil and sediment as these areas are sometimes inundated with water. These samples have been included in the discussions of both surface soil and sediment and have also been screened as both surface soil and sediment.

Pesticides have historically been detected in sediment samples collected from the PBA. A total of 29 sediment samples have been collected from the PBA and were analyzed for pesticides; 7 of these sediment samples were collected during the RI. All of these samples, with the exception of sample MWP1, exceed both screening levels, the reference concentration and the EPA Region 4 sediment screening level, for 4,4'-DDD, 4,4'DDE, and/or 4,4'-DDT. In addition, dieldrin was detected in one sample above both screening levels. Maximum detected concentrations of 4,4'-DDD, 4,4'DDE, and 4,4'-DDT results are 31, 1.2, and 34 mg/kg, respectively. A summary of detected pesticides is included in Table 5-3. Concentrations of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin are presented on Figure 5-3.

The pH of the sediment samples collected varies between 3.8 and 5.4. Sulfate concentrations at the PBA vary between not detected and 2,100 mg/kg in the sample collected from PBD/SS-1. TOC concentrations at the PBA collected vary between 7,400 and 110,000 mg/kg in sample PBD/SS-2. One sample, No. 5, was analyzed for TCLP 8 RCRA metals. Metals were not detected in the leachate from that sample.

Based on historical results, sediment samples in the PBA were not analyzed for metals or VOCs. Historically, PCBs were not detected in the sediment samples collected from the PBA. In addition, PCBs were not detected in any of the sediment samples collected during the RI.

Based on the results noted above, the extent of impacted sediment appears to be limited to the vicinity of the former Pesticide Burial Area along the western edge of the marsh and in the ditch. Based on flow measurement, the ditch does not appear to act as a significant pathway for the drainage of water from the PBA marsh under low flow conditions or under flow conditions represented by the storm event. In addition, surface water samples collected during the RI detected two pesticides at low concentrations in the sample closest to the former pesticide burial trench; however, these pesticides were not detected in the downstream sample located at the property line, which indicates that surface water is not transporting pesticides from the PBA offsite.

2.5.6.2.3 Groundwater

Historical data indicate groundwater impacts of metals, pesticides, and VOCs in the PBA. Additional groundwater samples were collected in the PBA to provide current data for groundwater quality characterization and for the evaluation of potential impact on downgradient receptors and surface water. Analytical results for groundwater samples collected in the PBA during the RI are summarized below. As discussed previously, groundwater flows in a southwest direction.

During the RI groundwater sampling event, one well in the PBA (PMW-3S) was analyzed for arsenic, lead, and mercury (primarily to provide upgradient data for the APA). Arsenic was detected in well PMW-3S at a concentration of 22 µg/L, which is slightly higher than the NCDENR 2L standard of 10 µg/L. Lead and mercury were not detected in the samples collected from the PBA.

During the RI groundwater sampling event, one VOC (benzene) was detected above the NCDENR 2L Standard. Benzene was detected in the sample collected from PMW-4S at a concentration of 8 µg/L (estimated), which is slightly above the NCDENR 2L Standard of 1 µg/L. Concentrations of VOCs are decreasing over time.

Historically, PCBs have not been detected in the groundwater samples collected from the PBA. Since further delineation was unnecessary, samples collected during the RI were not analyzed for PCBs.

During the RI groundwater sampling event, four pesticides (4,4'-DDD, 4,4'-DDT, alpha-chlordane, and heptachlor epoxide) were detected above the NCDENR 2L Standards in the groundwater samples collected from monitoring well PMW-4S. Concentrations of pesticides in well PMW-4S have been decreasing over time. All other PBA wells, including downgradient well PMW-3S, have either low or non-detectable concentrations of pesticides.

Groundwater samples collected during the RI were analyzed for sulfate. Sulfate was detected above the NCDENR 2L Standard of 250 mg/L in the samples collected from 4 of the 9 monitoring wells. Sulfate concentrations varied between 4 mg/L in the sample collected from monitoring well PMW-6D and 940 mg/L in the groundwater samples collected in from monitoring well PMW-3S. The area of sulfate-impacted groundwater is located east of the former fertilizer pile and is centered on monitoring well PMW-3S.

The pH of the shallow wells varies from 3.52 in monitoring well PMW-6S to 6.99 in monitoring well PMW-6S.

Downgradient monitoring well PMW-3S, as well as those monitoring wells in the APA, indicate that downgradient groundwater has not been impacted by contaminants from the PBA. In addition, surface water collected in the APA indicates no impacts from the PBA groundwater.

2.5.6.2.4 Surface Water

NCDENR and BBL collected surface water samples at the Site in 1988, 1994, 2003, and 2004. Historically, low levels of pesticides and metals were present in the surface water samples collected from the PBA. Two rounds of surface water samples were collected in 2003 and 2004 during low and high flow events.

Surface water samples were collected in the marsh (PBM/SW-1) and ditch (PBD/SW-3) of the PBA for use in ecological and human health risk assessment and to provide current data

for evaluating potential impacts of the discharge of shallow groundwater to the quality of surface water leaving the Site. In addition, surface water samples were collected from the drainage ditch during low and high/storm flow events to support qualitative evaluation of potential offsite impacts and to predict offsite impacts to surface water. A surface water sample could not be collected from proposed sample location PBM/SW-3 due to the lack of water present during both sampling events.

Flow measurements were performed at the time of sampling. Surface water samples collected in November 2003 were collected during a low flow event while the surface water samples collected in March 2004 were collected during a high/storm flow event. Samples in November 2003 were collected from standing water; no flow was observed. Sample PBM/SW-1 collected during the high flow event in March 2004 was collected from the marsh area; no flow was observed. Water flow in the ditch in the vicinity of sample PBD/SW-3 collected during the high flow event was measured to be approximately 0.18 cubic feet per second or 81 gallons per minute.

Historically, metals have been detected at low concentrations from surface water samples collected from the PBA. A total of 6 surface water samples collected from the PBA were analyzed for metals; 4 of these surface water samples were collected during the RI. Arsenic was detected in three surface water samples collected from the PBA at low concentrations that were above both the screening levels, the reference concentration and the selected surface water screening level. The surface water data screening levels were selected from the lesser of NCDENR's Surface Water Standards and EPA's Region 4 ecological freshwater surface water screening values. Surface water data were also screened against the reference concentrations. Arsenic was not detected in the surface water samples collected from similar locations in 2004. Several other metals, including aluminum, copper, iron, and zinc, were also present in sample PBD/SW-3 at concentrations greater than the screening levels while only aluminum and/or iron was above the screening levels in other surface water samples collected during the RI from the PBA. Metals concentrations were similar in both the total and dissolved metals analyses.

No VOCs were detected in the pre-RI surface water samples collected from the PBA. Samples collected during the RI were not analyzed for VOCs. PCBs were not detected in the pre-RI surface water samples collected from the PBA. PCBs were not detected in the surface water samples collected during the RI.

Pesticides were detected in surface water samples collected from the PBA in 1994 and 1998; however, only two pesticides (4,4'-DDD and 4,4'-DDE) were detected in the surface water samples collected from PBM/SW-1 during the RI at low concentrations that were above the selected surface water screening level but were less than the reference concentration. Pesticides were not detected in surface water sample PBD/SW-3, which was collected downstream of the PBA where the ditch exits the Site.

Sulfate concentrations in the sample collected from PBM/SW-1 exceed both the reference concentration of 34.1 mg/L and the selected surface water screening level of 250 mg/L.

The sulfate concentration for this sample is 470 mg/L (estimated) (500 mg/L in the duplicate sample) in the high flow (March 2004) sample. Sulfate concentrations were above the reference concentration but below the selected surface water screening level at the sample collected where the ditch exits the Site (PBD/SW-3). The pH in the surface water samples collected varies between 4.55 and 7.42.

No flow was observed at the marsh or upper reaches of the ditch in the PBA. Flow measurements were collected from the ditch sample (PBD/SW-3) during both the low flow and high flow events. During the low flow sampling event, no flow was observed (the surface water sample was collected from standing water). Modest flow at the downstream sample location (PBD/SW-3) during the high flow sampling event was approximately 0.18 cubic feet per second or 81 gallons per minute. Therefore, the ditch does not appear to act as a significant pathway for the drainage of water from the PBA marsh under low flow conditions or flow conditions represented by the storm event. The ditch in the PBA does not represent a significant transport pathway from the PBA offsite.

2.5.6.3 Underground Storage Tank Area

A groundwater sample was collected from monitoring well UMW-1 in the UST area. The sample was analyzed for lead, VOCs, and petroleum hydrocarbons (VPH). Xylene was detected at a concentration of 1.7 µg/L, which is less than the NCDENR 2L Standard of 530 µg/L. VPH concentrations were low, with aliphatic and aromatic hydrocarbons detected at concentrations of 30 µg/L and 32 µg/L, respectively.

### 2.5.7 Extent of Contamination and Potential for Migration

2.5.7.1 Acid Plant Area

The location and extent of contamination in the APA is shown on Figure 5. The large majority of the impacted area generally extends from the vicinity of the former condenser building south to the edge of the debris area and east to the edge of the former Barren Area. Lead contaminated soil closer to the condenser building extends to a depth of about 2 feet bgs.

Potential migration routes at the APA include surface water runoff, surface water infiltration, and groundwater transport. The APA is unpaved and is bound by paved roads on the south and west. Rainwater at the APA typically infiltrates directly into the ground; however, surficial beds of clay limit the rate of migration into the subsurface promoting surface water pooling and runoff. Historically, surface water in the APA drains into a ditch along Crocker Road that flows to the southeast toward Bawdy Swamp Creek. In addition, water from the APA flows via sheet flow approximately 1,100 feet southeast from the APA across low-lying areas to the Crocker Road Ditch (see Figure 2). Neither of these previously-reported surface water transport pathways was observed during any of the RI sampling events, including the high flow surface water sampling event. Bawdy Swamp Creek then becomes a low-lying area approximately 500 feet downstream, continues toward the south-southeast, and becomes

perennial approximately 1.5 miles downstream. Bawdy Swamp Creek enters the Neuse River approximately 12.5 miles further downstream, or roughly 14 miles downstream and southeast of the APA.

The most common analytes present in the APA soil, sediment, groundwater, and/or surface water are inorganics (such as arsenic, lead, or fluoride) that are relatively persistent in the environment. Arsenic and lead are the only analytes present in APA soil samples at concentrations greater than the screening levels, the reference concentration and the SRGs, that are also present in the groundwater beneath the APA at concentrations greater than the groundwater NCDENR 2L Standards. This indicates that these analytes have likely been transported from soil to groundwater by infiltrating rainwater and/or a shallow water table. Deep wells within the APA do not contain any analytes above the NCDENR 2L Standards. This indicates that the downward migration of analytes in the groundwater is mitigated either by a slow vertical gradient or by a subsurface geo-chemical process (i.e., sorption, precipitation). In addition, in downgradient well AMW-9S, arsenic was not detected and lead was detected at a concentration less than the NCDENR 2L Standards, indicating some retardation of arsenic and lead transport by Site soil.

The analyte migration potential can be evaluated from a review of the sediment data from the APA. Arsenic and lead concentrations exceed the EPA Region 4 sediment screening levels in most sediment samples collected; however, during the RI sampling events (soil/sediment and biota) no surface water drainage pathways were observed from the southern area of the APA (i.e., the Acid Wash Area) to offsite ditches. Nonetheless, elevated concentrations of arsenic and/or lead are present in sediment samples collected from Bawdy Swamp Creek and Crocker Road Ditch at and just upstream of the intersection of these two features.

Based on the concentrations of arsenic and lead in the surface water sample AW/SW-1, it appears that shallow groundwater does not significantly impact the quality of the surface water in this area of the Site. Concentrations of arsenic and lead collected from the drainage during the high flow event were less than the reference concentration but greater than the selected screening levels and were used as the estimate of concentrations of surface water in the drainage. In addition, the absence of arsenic and very low concentration of lead in the groundwater sample from well AMW-9S (located near Bawdy Swamp Creek) indicate that groundwater is not the source of the lead in Bawdy Swamp Creek surface water sample AW/SW-4.

2.5.7.2 Pesticide Burial Area

The PBA is the former location of approximately 147 drums of pesticides that were buried in 1974 and removed in December 1994/January 1995. The analytes present in the PBA soil, sediment, groundwater, and/or surface water are primarily organochlorine pesticides (i.e., 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, etc.) that are relatively persistent in the environment.

Potential migration routes at the PBA include surface water runoff, surface water infiltration, and groundwater transport. The PBA is unpaved and is bordered by a paved road on

the west. Rainwater at the PBA typically infiltrates directly into the ground; however, surficial beds of clay limit the rate of migration into the subsurface promoting surface water pooling and runoff. Surface water in the PBA drains into a ditch that flows towards the northeast. After reaching the ditch, water from the PBA flows through the associated low-lying areas and a small marsh within them. Water from the low-lying areas and marsh flows to the north to the railroad ditch then drains to the east into an intermittent stream. The intermittent stream flows toward the southeast and joins Moccasin Creek approximately one mile downgradient of the PBA. Moccasin Creek flows approximately 6.5 miles to the southeast into Holts Pond, and continues toward the southeast approximately 5.5 additional miles to Raccoon Swamp, which is roughly 15 miles downgradient of the PBA. Moccasin Creek continues through the Raccoon Swamp area approximately 2 miles to the Neuse River.

Impacted sediment appears to be limited to the vicinity of the former Pesticide Burial Area along the western edge of the marsh and in the ditch. Based on flow measurement, the ditch does not appear to act as a significant pathway for the drainage of water from the PBA marsh under low flow conditions or flow conditions represented by the high flow event. In addition, surface water samples collected during the RI detected two pesticides at low concentrations in the sample closest to the former pesticide burial trench; however, these pesticides were not detected in the downstream sample located at the property line, which indicates that surface water is not transporting pesticides from the PBA offsite.

At one location in the PBA (PMW-4S), analytes above the reference concentration and the SRGs in soil are present in the shallow groundwater. Shallow groundwater monitoring well PMW-4S contains benzene, 4,4'-DDD, 4,4'-DDT, alpha-chlordane, and heptachlor epoxide above the NCDENR 2L Standards (Figure 5-6). Concentrations of these VOCs and pesticides were not detected in downgradient wells PMW-1S or PMW-3S. In addition, results from groundwater samples collected from the deep wells within the PBA did not exceed the NCDENR 2L Standards. Groundwater impacts within the PBA are limited to the vicinity of PMW-4S.

2.5.7.3 Underground Storage Tank Area

Groundwater collected from monitoring well UST-1 contains low concentrations of xylene and VPH that are less than the NCDENR 2L Standards. Concentrations of xylenes in the groundwater in the APA and PBA were either low or not detected. In addition, xylene was not detected in any of the surface water samples collected. Therefore there are no groundwater impacts within the UST Area.

Potential migration routes at the UST Area include surface water runoff, surface water infiltration, and groundwater transport. Rainwater at the UST Area typically infiltrates directly into the ground; however, surficial beds of clay limit the rate of migration into the subsurface promoting surface water pooling and runoff. Surface water in the UST Area is contained by the raised beds of the railroad tracks that surround the UST Area; therefore, there is no surface water runoff from the UST Area.

## 2.6 Current and Potential Future Land and Water Uses

### 2.6.1 Land Uses

The Facility and properties along the portion of East Preston Street that parallel the Site boundary are currently zoned as heavy industrial, and properties along Crocker Road are zoned as heavy industrial or for business. Land use beyond the portion of East Preston Street that parallels the Site boundary is primarily industrial/commercial, but also consists of areas of undeveloped land and several private residences. The Site's proximity to Interstate 95, land zoned as industrial and business and the presence of rail lines along some of the property boundary and across the Site suggest that future industrial/commercial use is likely.

### 2.6.2 Groundwater Uses

Groundwater at the Site is classified as GA, a potential source of drinking water, based on the NCDENR groundwater classification rules (15A NCAC 02L.0201). There are no current groundwater users at the Site. The industry operating adjacent to the Site uses the municipal water supply and is expected to continue using municipal water. The majority of the residences in Selma are supplied either by city or county water. The eight public water supply wells, and two future supply wells, are located cross gradient of the Site. In addition, the few potential receptors with private wells located within one mile of the Site are also located either upgradient or crossgradient of the Site. There are no potential receptors to groundwater within a one mile radius downgradient of the Site. Although there are no current receptors to groundwater within a one mile radius downgradient of the Site, since groundwater at the Site is classified as GA, a potential source of drinking water, groundwater may potentially be used by potential industrial, commercial and residential receptors downgradient of the Site in the future.

## 2.7 Summary of Site Risks

The baseline risk assessment estimates what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this Site.

### 2.7.1 Summary of Human Health Risk Assessment

2.7.1.1 Identification of Contaminants of Concern

Samples have been collected from soil, sediment, surface water and groundwater at the Site. Chemicals detected in these samples were compared to screening values appropriate for each media to arrive at contaminants of potential concern (COPCs). Soil sampling results were screened against the NCDENR Inactive Hazardous Waste Site Remediation Goals. Groundwater results were screened against the NCDENR 2L Groundwater Standards. Sediment results were screened against EPA R4 Waste Management Division Sediment Screening Values for

Hazardous Waste Sites. Surface water results were screened against NCDENR Surface Water Standards and EPA R4 Ecological Freshwater Screening Values. Concentrations of COPCs evaluated in the HHRA are included in the Risk Assessment Tables attached to this ROD.

Contaminants of Concern (COCs) are the COPCs that significantly contribute to an exposure pathway that exceed either a 1x10-4 cumulative site cancer risk or exceed a non-carcinogenic hazard index of 1. In addition, a contaminant may be retained as a COC if the observed concentration exceeds a state or federal chemical-specific ARAR or if they have the potential to leach to groundwater at levels exceeding a maximum contaminant level (MCL).

Only soil and groundwater were found to have COCs that contributed to unacceptable risk. The soil COCs are lead (due to unacceptable risk for humans and the potential to leach from soil to groundwater) and arsenic (potential to leach from soil to groundwater). As shown in Tables 2 and 3 below, two COCs were retained in soil and nine COCs were found in groundwater. The tables include the range of concentrations detected for each COC, as well as the frequency of detection. The concentrations of lead in soil noted in Table 2 below include the range of contaminants detected for all depths of soil sampled (0-4 feet bgs). Lead is the human health risk driver for the soil clean-up.

**Table 2**
**Soil Contaminant Concentrations**

| Chemical | Minimum Concentration | Maximum Concentration | units | Detection Frequency | Arithmetic Average |
|---|---|---|---|---|---|
| Arsenic | 0.6 | 310 | Mg/kg | 77/83 | 21.3 |
| Lead | 13 | 36,000 | Mg/kg | 43/43 | 3120 |

Groundwater contaminants do not pose a risk to humans under current conditions at the Site since the groundwater is not used or consumed at this time. However, groundwater contaminants are present above primary federal Maximum Contaminant Level (MCLs) or NCDENR groundwater standards as noted below in Table 3.

**Table 3**
**Groundwater Contaminants Exceeding Primary Drinking Water Standards or State Groundwater Standards**

| Chemical | Minimum Concentration | Maximum Concentration | units | Detection Frequency | Arithmetic Average | Federal or State Standard |
|---|---|---|---|---|---|---|
| Arsenic | 11 | 120 | µg/L | 7/12 | 35 | 10 ug/l [1] |
| Fluoride | 0.63 | 170 | mg/L | 6/12 | 19 | 4 mg/l [1] |
| Lead | 7.3 | 380 | µg/L | 6/12 | 84 | 15 ug/l [1] |
| Benzene | 1 | 65 | µg/L | 3/20 | 4 | 1 ug/l [2] |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1,2 dichloropropane | 0.5 | 7.4 | µg/L | 2/11 | 1.18 | 0.56 ug/l [2] |
| Heptachlor epoxide | 0.75 | 0.75 | µg/L | 1/9 | 0.11 | 0.0038 ug/l [2] |
| 4,4' DDT | 0.53 | 0.53 | µg/L | 1/9 | 0.1 | 0.14 ug/l [2] |
| 4,4' DDD | 0.33 | 0.33 | µg/L | 1/9 | 0.08 | 0. ug/l [2] |
| Gamma-BHC (lindane) | 0.01 | 0.19 | µg/L | 3/9 | 0.04 | 0.2 ug/l [2] |
| [1] Federal drinking water standard or action level<br>[2] NCDENR 2L groundwater standard | | | | | | |

The exposure point concentrations used to estimate the risk for each COC and the type of statistical measure it represents are presented in the Table: Summary of Exposure Point Concentrations, in Part 6 of this ROD. The 95% Upper Confidence Level on the arithmetic mean was used as the exposure point concentration for all COCs with datasets with sample sizes greater than 10. The maximum concentration was used as the exposure point concentration for datasets with sample sizes less than 10.

2.7.1.2 Exposure Assessment

A Conceptual Site Model was developed for the Site to evaluate potential exposure pathways (see Table 1 in Section 2.5.1). Data from several soil depths were used to evaluate the potential risk associated with direct contact with soils associated with the selected exposure pathways noted in Table 1. Soil from the 0 – 0.5 foot depth interval was considered to represent surface soil to which the trespasser, industrial worker, and construction worker may be directly exposed. According to EPA (2002b) guidance, an industrial worker (i.e., outdoor worker) may be directly exposed to surface and "shallow subsurface" soil, which are defined as soil depths from 1 inch to 2 feet bgs. Therefore, the 1.0 – 2.0 foot depth interval was considered to represent shallow subsurface soil to which the industrial worker may be exposed. Construction workers may be exposed to surface (0 – 0.5 feet bgs), shallow subsurface (1.0 – 2.0 feet bgs), and subsurface (>2 feet bgs) soil. Soil samples were collected to depths of 4 feet bgs. Therefore, the 1.0 – 4.0 foot depth interval was considered to represent subsurface soil to which the construction worker may be directly exposed. A summary of exposure factors can be found in the attached risk assessment tables in Part 6 of this ROD.

Future residential use of the Site was not evaluated in the risk assessment because it does not appear to be a realistic future use of the Site. The Site and nearby properties are zoned heavy industrial. The Site's proximity to Interstate 95 and the presence of rail lines along some of the property boundary and across the Site suggest that future industrial/commercial use is likely.

Depth to groundwater generally ranges from 2 to 6 feet bgs across the Site. Although shallow groundwater at the Site is not being currently used as a potable source, there is potential for onsite construction workers to be exposed to groundwater at the site.

Future use of the groundwater at the Site will likely be industrial use, and residential use downgradient from the site. Groundwater at the Site is classified as GA, a potential source of drinking water. Even though there are no current users of the groundwater, it may potentially be used by potential industrial, commercial and residential receptors downgradient of the Site in the future. Therefore, federal Maximum Contaminant Level (MCLs) for drinking water or NCDENR groundwater standards, are used to evaluate potential future risk to groundwater contamination.

There are several drainage ditches and wetland areas present within the PBA and APA. Surface water in these areas is generally ephemeral in nature, and these areas only contain standing water for short periods of time throughout the year. However, surface water does present a potential exposure pathway for onsite receptors. Sediments within these surface water bodies also represent a potential exposure pathway. Consistent with EPA (2000) Region IV guidance, substrate within these drainage ditches and wetlands is considered as surface soil when no standing water is present (several of the soil samples were evaluated as both sediment and soil in the HHRA).

Pesticide Burial Area

Due to the screening process described in section 2.7.1.1, no COPCs were identified for PBA surface soil or sediment. COPCs were only identified for PBA surface water and groundwater. Complete exposure pathways were only evaluated for media in which COPCs were identified. Therefore complete exposure pathways were quantitatively evaluated for the PBA are:

- Trespasser exposure to surface water via dermal contact and incidental ingestion;
- Industrial worker exposure to surface water via dermal contact and incidental ingestion; and
- Construction worker exposure to surface water and groundwater via dermal contact and incidental ingestion.

Acid Plant Area

Due to the screening process described in section 2.7.1.1, no COPCs were identified for APA sediment or surface water. COPCs were identified for surface, shallow subsurface, and subsurface soil, and groundwater. Complete exposure pathways were only evaluated for media in which COPCs were identified. Therefore, complete exposure pathways that were quantitatively evaluated for the APA are:

- Trespasser exposure to surface (0 – 0.5 feet bgs) soil via dermal contact, incidental ingestion, and inhalation of particulate matter;
- Industrial worker exposure to surface (0 – 0.5 feet bgs) and shallow subsurface (1.0 – 2.0 feet bgs) soil via dermal contact, incidental ingestion, and inhalation of particulate matter; and
- Construction worker exposure to surface (0 – 0.5 feet bgs), shallow subsurface (1.0 – 2.0 feet bgs), and subsurface (>2 feet bgs) soil via dermal contact, incidental ingestion, and inhalation of particulate matter, and to groundwater via dermal contact and incidental ingestion.

The HHRA uses exposure and toxicity factors that reflect current scientific and regulatory policy and represent conditions at the Site. While some exposure factors are the EPA default values, others are site-specific values that reflect potential exposures at the Site. The Reasonable Maximum Exposure (RME) scenario is evaluated in this HHRA for trespasser, industrial worker, and construction worker receptors, and is intended to represent the "highest exposure that is reasonably expected to occur at a site" (EPA, 1989). The RME scenario uses EPA (2002b) default values for soil ingestion (100 mg/day for trespassers and industrial workers, and 330 mg/day for the construction worker) and site-specific values for exposure frequency for the trespasser and construction worker (52 and 30 days per year, respectively). The EPA (2002b) default exposure frequency of 225 days per year is used to evaluate potential industrial worker exposures.

Potential surface water and groundwater exposures are evaluated assuming a recreational scenario (i.e., incidental ingestion of water) rather than a residential scenario (i.e., ingestion of drinking water). The EPA (2000) Region IV intake rate of 10 milliliters per hour (which is based on exposures to surface water during wading) is used to evaluate potential surface water exposures to trespassers, industrial workers, and construction workers. To evaluate potential exposures of construction workers to groundwater, the EPA (1989) default intake rate of 50 milliliters per hour is used.

The Site is characterized by heavily vegetated forests, successional fields, scrub-shrub, and wetland habitats, and much of the Site perimeter is fenced. Surrounding land use is primarily industrial/commercial, but also consists of areas of undeveloped land and several private residences. Based on this information, it is assumed that there is potential for nearby adolescents to trespass onto Site property. The site-specific exposure frequency for the trespasser assumes that this receptor may spend 1 day per week at the Site for 52 weeks per year for 10 years. Consistent with EPA (2000) Region IV guidance, the trespasser is assumed to represent an adolescent aged 7 to 16 years.

The industrial worker is assumed to be an outdoor worker that may be exposed to Site media during routine maintenance activities. Exposure of the industrial worker is assumed to occur 225 days per year for 25 years. The construction worker is assumed to be involved in intrusive activities (e.g., excavation) that may occur at the Site (e.g., underground utility repair). Exposure of the construction worker is assumed to occur for 30 days per year for 1 year

(assumes that construction activities would occur during a single construction season). Construction worker exposure to groundwater is assumed to represent 25% of an 8-hour work day (i.e., 2 hours per day) because exposure to groundwater is not likely to be continuous over an 8-hour work day.

2.7.1.3 Toxicity Assessment

The potential risks associated with future commercial/industrial exposure to lead were evaluated with the Adult Lead Model (ALM). Toxicity information for other contaminants evaluated in the risk assessment, but which were determined to not pose unacceptable risk, can be found in the attached risk assessment tables in Part 6 of this ROD. A summary of the results of the ALM is found in Section 2.7.1.4.

2.7.1.4 Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

where:

Risk = a unitless probability (e.g., $2 \times 10^{-5}$) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as (mg/kg-day)-1

An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the RME estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is $1x10^{-4}$ to $1x10^{-6}$.

For non-carcinogenic effects, the potential is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a Hazard Quotient (HQ). A HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. A HI less than 1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes,

toxic noncarcinogenic effects from all contaminants are unlikely. A HI greater than 1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

where:

CDI = Chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term)

Based on the results of the HHRA, the only contaminant that presents unacceptable future risk is lead. The potential risks associated with the other contaminants do not exceed EPA's acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$. Also, the calculated non-cancer hazard indices are much less than 1.0 (see Table 4 for Risk Summary).

The potential risks associated with future commercial/industrial exposure to lead were evaluated with the Adult Lead Model (ALM). The ALM approach also considers the potential impacts to young children of having elevated blood lead concentrations. To achieve this goal, adult lead exposures are modeled for a narrowly defined receptor population (*i.e.*, an adult female worker of child-bearing age at a non-residential site or with non-residential exposure scenarios) and specific media such as soil. The Adult Lead Model (ALM) uses a simplified representation of lead biokinetics to predict quasi-steady state blood-lead concentrations among adults who have relatively steady patterns of site exposures. In the ALM mathematic models, the assumption is made that if the calculated blood-lead concentrations are acceptable for the most conservative receptors, then the lead concentrations in soil will be acceptable for adult exposure scenarios as well.

The results of the ALM indicate that in order to ensure that the blood lead level in a developing fetus of a hypothetical future female Site worker remains at or below 10 micrograms per deciliter (μg/dL), the lead concentration in soil should not exceed 665 parts per million (ppm) (assuming a heterogeneous group of potential Site workers). Summary results from the ALM are presented in Tables 5 and 6.

**TABLE 4: SUMMARY OF CARCINOGENIC RISKS AND NON-CARCINOGENIC HAZARDS**

| Area of Concern | Exposure Media | Receptor | Total Carcinogenic Risks | Total Non-Cancer Hazards |
|---|---|---|---|---|
| APA | Surface soil (0-0.5 ft) | Trespasser | 2.E-06 | 0.03 |
| | Surface and shallow subsurface soil (0-2 ft) | Industrial worker | 1.E-05 | 0.08 |
| | Surface and subsurface soil (0-4 ft); Groundwater | Construction worker | 3.E-07 | 0.05 |
| | | | | |
| PBA | Surface water | Trespasser | 2.E-07 | 0.01 |
| | | Industrial worker | 1.E-06 | 0.01 |
| | Surface water; Groundwater | Construction worker | 1.E-07 | 0.04 |

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**TABLE 5**

**ADULT LEAD MODEL:**
**CALCULATIONS OF BLOOD LEAD CONCENTRATIONS**

| Exposure Variable | PbB Equation[1] 1 | PbB Equation[1] 2 | Description of Exposure Variable | Units | Values for Non-Residential Exposure Scenario | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Using Equation 1 | | Using Equation 2 | |
| | | | | | GSD = Hom | GSD = Het | GSD = Hom | GSD = Het |
| PbS | X | X | Soil lead concentration | ug/g or ppm | 2280 | 2280 | 2280 | 2280 |
| $R_{fetal/maternal}$ | X | X | Fetal/maternal PbB ratio | -- | 0.9 | 0.9 | 0.9 | 0.9 |
| BKSF | X | X | Biokinetic Slope Factor | ug/dL per ug/day | 0.4 | 0.4 | 0.4 | 0.4 |
| $GSD_i$ | X | X | Geometric standard deviation PbB | -- | 2.0 | 2.1 | 2.0 | 2.1 |
| $PbB_0$ | X | X | Baseline PbB | ug/dL | 1.3 | 1.4 | 1.3 | 1.4 |
| $IR_S$ | X | | Soil ingestion rate (including soil-derived indoor dust) | g/day | 0.100 | 0.100 | -- | -- |
| $IR_{S+D}$ | | X | Total ingestion rate of outdoor soil and indoor dust | g/day | -- | -- | 0.100 | 0.100 |
| $W_S$ | | X | Weighting factor; fraction of $IR_{S+D}$ ingested as outdoor soil | -- | -- | -- | 1.0 | 1.0 |
| $K_{SD}$ | | X | Mass fraction of soil in dust | -- | -- | -- | 0.7 | 0.7 |
| $AF_{S,D}$ | X | X | Absorption fraction (same for soil and dust) | -- | 0.12 | 0.12 | 0.12 | 0.12 |
| $EF_{S,D}$ | X | X | Exposure frequency (same for soil and dust) | days/yr | 225 | 225 | 225 | 225 |
| $AT_{S,D}$ | X | X | Averaging time (same for soil and dust) | days/yr | 365 | 365 | 365 | 365 |
| **$PbB_{adult}$** | **PbB of adult worker, geometric mean** | | | **ug/dL** | **8.0** | **8.1** | **8.0** | **8.1** |
| **$PbB_{fetal,\ 0.95}$** | **95th percentile PbB among fetuses of adult workers** | | | **ug/dL** | **23.4** | **24.2** | **23.4** | **24.2** |
| **$PbB_t$** | **Target PbB level of concern (e.g., 10 ug/dL)** | | | **ug/dL** | **10.0** | **10.0** | **10.0** | **10.0** |
| **$P(PbB_{fetal} > PbB_t)$** | **Probability that fetal PbB > $PbB_t$, assuming lognormal distribution** | | | **%** | **32.5%** | **33.4%** | **32.5%** | **33.4%** |

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes $W_S$, $K_{SD}$).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

| | |
|---|---|
| $PbB_{adult} =$ | $(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$ |
| $PbB_{fetal,\ 0.95} =$ | $PbB_{adult} * (GSD_i^{1.645} * R)$ |

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

| | |
|---|---|
| $PbB_{adult} =$ | $PbS*BKSF*(((IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D]))/365+PbB_0$ |
| $PbB_{fetal,\ 0.95} =$ | $PbB_{adult} * (GSD_i^{1.645} * R)$ |

Source: USEPA. 2003. Recommendations of the Technical Review Workshop for Lead for an Approach to Assessing Risks Associated with Adult Exposures to EPA-540-R-03-001. January 2003.

**TABLE 6**

**ADULT LEAD MODEL:**
**CALCULATIONS OF SITE-SPECIFIC PRELIMINARY REMEDIATION GOALS**

| Exposure Variable | Equation 1* | Equation 2** | Description of Exposure Variable | Units | Using Equation 1* | | Using Equation 2** | |
|---|---|---|---|---|---|---|---|---|
| | | | | | GSD$_i$ = Hom | GSD$_i$ = Het | GSD$_i$ = Hom | GSD$_i$ = Het |
| $PbB_{fetal,\ 0.95}$ | X | X | 95$^{th}$ percentile PbB in fetus | ug/dL | 10 | 10 | 10 | 10 |
| $R_{fetal/maternal}$ | X | X | Fetal/maternal PbB ratio | -- | 0.9 | 0.9 | 0.9 | 0.9 |
| BKSF | X | X | Biokinetic Slope Factor | ug/dL per ug/day | 0.4 | 0.4 | 0.4 | 0.4 |
| $GSD_i$ | X | X | Geometric standard deviation PbB | -- | 2.0 | 2.1 | 2.0 | 2.1 |
| $PbB_0$ | X | X | Baseline PbB | ug/dL | 1.3 | 1.4 | 1.3 | 1.4 |
| $IR_S$ | X | | Soil ingestion rate (including soil-derived indoor dust) | g/day | 0.100 | 0.100 | -- | -- |
| $IR_{S+D}$ | | X | Total ingestion rate of outdoor soil and indoor dust | g/day | -- | -- | 0.100 | 0.100 |
| $W_S$ | | X | Weighting factor; fraction of $IR_{S+D}$ ingested as outdoor soil | -- | -- | -- | 1.0 | 1.0 |
| $K_{SD}$ | | X | Mass fraction of soil in dust | -- | -- | -- | 0.7 | 0.7 |
| $AF_{S,D}$ | X | X | Absorption fraction (same for soil and dust) | -- | 0.12 | 0.12 | 0.12 | 0.12 |
| $EF_{S,D}$ | X | X | Exposure frequency (same for soil and dust) | days/yr | 225 | 225 | 225 | 225 |
| $AT_{S,D}$ | X | X | Averaging time (same for soil and dust) | days/yr | 365 | 365 | 365 | 365 |
| **PRG** | | | **Preliminary Remediation Goal** | **ppm** | **723** | **665** | **723** | **665** |

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes $W_S$, $K_{SD}$).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same PRG.

***Equation 1, based on Eq. 4 in USEPA (1996).**

$$PRG = \frac{([PbB_{95}fetal/(R*(GSD_i^{1.645})])-PbB_0)*AT_{S,D}}{BKSF*(IR_{S+D}*AF_{S,D}*EF_{S,D})}$$

****Equation 2, alternate approach based on Eq. 4 and Eq. A-19 in USEPA (1996).**

$$PRG = \frac{([PbB_{fetal,0.95}/(R*(GSD_i^{1.645})])-PbB_0)*AT_{S,D}}{BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])}$$

Source: USEPA. 2003. Recommendations of the Technical Review Workshop for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. EPA-540-R-03-001. January 2003.

2.7.1.5 Uncertainties

There are various sources of uncertainty inherent in the risk assessment process. These include uncertainties associated with exposure parameters and toxicity factors for which conservative assumptions are typically used so as not to underestimate risk. The objective of an uncertainty analysis is to present key information regarding assumptions and uncertainties in the risk assessment process to place the quantitative risk estimates in proper perspective (EPA, 1989).

A site-specific exposure frequency of 52 days per year (1 day per week for 52 weeks) was used to estimate potential risks to trespassers in the PBA and APA. Land use surrounding the Site is primarily industrial/commercial, although there are also a few private dwellings and patches of undeveloped land in the vicinity of the Site as well. The majority of the Site perimeter is fenced. The Site itself is characterized as forested, scrub-shrub, successional field, and wetland habitats, and is heavily vegetated in most areas of the PBA and APA, which most likely limits the Site's attractiveness to potential trespassers. Based on the physical setting of the Site and the fact that there are limited residences nearby, the trespasser exposure frequency is most likely a conservative estimate.

The EPA (2002b) default exposure frequency of 225 days per year for the industrial/commercial outdoor worker was used to estimate potential risks to industrial workers in the PBA and APA. The outdoor worker is defined as "a long-term receptor exposed during the work day who is a full time employee of the company operating onsite and who spends most of their workday conducting maintenance activities outdoors (e.g., moderate digging, landscaping)" (EPA, 2002b). The Site is currently an inactive facility and generally requires minimal regular maintenance because the majority of the buildings onsite have been demolished and there are no areas currently maintained by mowing. Therefore, use of the EPA (2002b) default exposure frequency for the outdoor worker is considered to be conservative and most likely overestimates actual Site use at least for the near future.

The HHRA used an EPA (2002b) default soil ingestion rate of 330 mg/day for construction workers. According to EPA (2002b), this high-end soil ingestion rate was chosen because construction workers "are likely to experience substantial exposures to soil during excavation and other work activities..." The soil ingestion rate of 330 mg/day is based on a study by Stanek et al. (1997) and is the 95$^{th}$ percentile soil intake value for adults in that study. For reasons discussed below, use of the 330 mg/day value provides a highly conservative estimate of construction worker exposure.

Stanek et al. (1997) reported a 95$^{th}$ percentile soil ingestion rate for adults of 331 mg/day. This soil ingestion rate, however, was apparently influenced by a single individual with a compromised health status, and was characterized in the study as being "substantially uncertain." According to Calabrese (2003) (one of the paper's co-authors), the result obtained from this individual does not reflect a daily soil ingestion rate, but rather represents soil accumulation over

a 3 to 4 day period. As such, Calabrese (2003) stated that the soil ingestion rate of 331 mg/day is "uncertain, unstable, and artificially inflated," and recommended use of the upper 75$^{th}$ percentile value from this study (49 mg/day) which represents a more stable high-end soil ingestion rate.

Other high-end soil ingestion rates have been recommended by EPA and state agencies that are less than 330 mg/day. For example, in deriving soil screening levels, EPA (2002b) recommends a soil ingestion rate of 100 mg/day for outdoor workers engaged in "contact intensive activities." A "contact-intense" soil ingestion rate of 100 mg/day is also recommended by EPA for use in the ALM (EPA, 2003d). In addition, the Massachusetts Department of Environmental Protection has updated its enhanced soil ingestion rate for a utility/heavy construction worker from 500 mg/day (based on a study by Hawley 1995), to 100 mg/day (MDEP, 2003). As such, use of the 330 mg/day soil ingestion rate for construction workers at the Site is a conservative approach in that actual exposures are unlikely to be higher, and may be much lower, than the default value.

The surface water and groundwater intake values used to estimate potential risks associated with incidental ingestion of these media by onsite receptors reflect intake rates for swimming and wading exposures (EPA, 2000). The surface water bodies onsite are relatively small and only contain standing water for short periods of time throughout the year, which precludes use of these areas for recreational activities such as swimming and wading. Also, swimming and wading are assumed to reflect more "contact-intense" activities than trespasser or occupational exposures. Therefore, use of these recreational intake rates to estimate risks associated with surface water and groundwater exposures is conservative and may overestimate risks. Furthermore, estimating risks under the assumption that surface water exposures can occur year-round is considered to be conservative and not reflective of actual Site exposures.

Some of the analytical data utilized in the risk assessment were qualified as "J". This qualifier indicates that the actual concentration may be higher or lower than the amount reported.

Non-detected chemicals were reported by the laboratory as less than the Sample Quantification Limit (SQL). In the risk assessment, if a chemical was reported as nondetect, it was assumed to be present at one-half of the SQL for that sample in the calculation of the 95% upper confidence limit of the mean concentration. This may result in either over- or under-estimation of the actual exposure concentration.

RfDs and CSFs for the COPCs were derived from EPA sources. RfDs are determined with varying degrees of uncertainty depending on such factors as the basis for the RfD (no-observed-adverse-effect-level, NOAEL vs. lowest-observed-adverse-effect-level, LOAEL), species (animal or human), and professional judgment. The calculated RfD is therefore likely overly protective, and its use may result in an overestimation of non-cancer risk. Similarly, the CSFs developed by EPA are generally conservative and represent the upper-bound limit of the carcinogenic potency of each chemical.

Each complete exposure pathway may involve more than one contaminant. There are uncertainties associated with summing risks or hazard quotients for multiple substances in the risk characterization step. The assumption ignores the possibility of synergistic or antagonistic activities in the metabolism of the contaminants. This could result in over-or under- estimation of risk.

The potential risks evaluated for the Site were directly related to COPCs detected in the environmental media at this site. No attempt was made to differentiate between the risk contributions from other sites and those being contributed from the Site.

All of the uncertainties ultimately affect the risk estimate. Most of the uncertainties identified will likely result in the potential for overestimation of risk (e.g., the combination of several upper-bound assumptions for some exposure scenarios).

### 2.7.2 Summary of Ecological Risk Assessment

The objective of the Ecological Risk Assessment (ERA) was to use recent site-specific data to evaluate potential ecological risks at the Site. The recent RI data used in the ERA included soil, sediment, surface water, and biota (tissue) data.

The ERA process is an eight step process as described in EPA's Ecological Risk Assessment Guidance for Superfund (EPA, 1997). The first two steps (Step 1 - screening-level problem formulation and ecological effects evaluation; Step 2 - screening-level preliminary exposure estimate and risk calculation) were completed in the Draft Preliminary Ecological Risk Assessment and related agreements. Step 3 (Problem Formulation) was finalized in December 2002. Step 3 established four fundamental items: contaminants of concern, assessment endpoints, exposure pathways, and risk questions. Step 4 (Study Design and Data Quality Objective Process) included an ERA Work Plan (WP) and Sampling and Analysis Plan (SAP). The WP identified measurement endpoints for the ERA and completed the site conceptual model. Step 5 (Verification of Field Sampling Design) and Step 6 (Site Investigation and Data Analysis) were completed in the field in 2003, 2004, and 2005. The field work included the collection of soil, sediment, surface water, and biota (invertebrates, frogs, and small mammals). Step 7 (Risk Characterization), and Step 8 (Risk Management) are incorporated in the Feasibility Study and this Record of Decision.

#### 2.7.2.1 Identification of Chemicals of Concern

For metals, the EPA Region 4 screening values are based on Oak Ridge National Laboratory's (ORNL's) soil screening benchmarks for invertebrates (Efroymson et al., 1997). The benchmarks for invertebrates were used to evaluate potential risks to soil invertebrates from metals (i.e., arsenic, lead, and mercury). For pesticides, the ecological soil screening benchmarks recommended by EPA Region 4 (2001) are used because ORNL does not provide invertebrate benchmarks for these constituents. EPA Region 4 (2001) does not provide a

benchmark for toxaphene; therefore, the EPA (2003) Region 5 Ecological Soil Screening Level (Eco-SSL) was used for this constituent.

EPA (1996) Ecotox Thresholds (ETs) were used to evaluate potential risks to sediment invertebrates. These benchmarks represent a measure of direct toxicity to exposed organisms based upon studies reported in the scientific literature, and are based on endpoints including reductions in survival, growth, or reproduction in laboratory and field studies (EPA, 1996). Additional sediment benchmarks were also considered during the sediment data evaluation, including the more recent threshold effect concentration (TEC) and probable effect concentration (PEC) values developed by MacDonald et al. (2000).

For surface water, EPA (2001) Region 4 freshwater surface water screening values are used to evaluate potential risks to aquatic species. These benchmarks represent the chronic ambient water quality criteria values for the protection of aquatic life. The surface water benchmark for lead is hardness-dependent and is adjusted using site-specific hardness data.

The chemicals of potential concern (COPC) for soil and sediment in the APA were arsenic, lead, and mercury. Based on the risk calculations, the only chemical of concern for ecological receptors in the APA is lead in soil. The maximum concentration of lead in RI sediment samples was 180 ppm which was approximately equal to the reference concentration of 178 ppm (2 times average background). The maximum lead concentration in pre-RI sediment samples was 870 ppm. The following Table 7 presents the ecological exposure point concentrations for the APA.

The COPCs for the PBA were DDT (and metabolites DDD and DDE), endrin, and toxaphene. However, there was no calculated excess risk to environmental receptors in the PBA, so ultimately there were no chemicals of concern (COC) retained for environmental receptors in the PBA. A HQ Summary for the PBA is included as an attachment in Part 6 of this ROD.

2.7.2.2 Exposure Assessment

The Site is a former industrial facility that has evolved into naturalized habitats (e.g., successional fields, shrub/forested uplands). Both the PBA and the APA are overgrown with vegetation, except for the railroad tracks that traverse the Site in several locations and dilapidated buildings that were part of the fertilizer facility. An active grain mill is located northwest of the Site, and the railroad spurs that traverse the Site are actively used by the grain mill to transport goods and as a switching area for railroad cars. The railroad spurs are currently the only actively used portion of the Site, and a portion of the property adjacent to the railroad spurs has recently been cleared. The remainder of the Site has since been colonized by herbaceous and woody vegetation as a result of natural succession.

Habitats present within the APA include successional field, tall grass/field, mixed hardwood/coniferous forest, mixed emergent/scrub-shrub/forested wetland, and an intermittent stream. Other areas of the APA include an active railroad spur and recently cleared areas.

**Table 7**

**Ecological**
**Exposure Point Concentrations - Acid Plant Area[1]**

| Media | Concentration (mg/kg) | | | Notes |
|---|---|---|---|---|
| | arsenic | lead | mercury | |
| Soil | 18.50 | 3,190 | 0.35 | Arithmetic mean of the 2003 and 2005 RI soil data collected by BBL. |
| Sediment | 3.95 | 98 | 0.10 | Arithmetic mean of the 2003 RI sediment data collected by BBL. |
| Invertebrates | 4.20 | 158 | 0.058 | Arithmetic mean of the 2003 invertebrate data collected by BBL. |
| Frogs | 0.38 | 1.2 | 0.028 | Arithmetic mean of the 2004 frog data collected by BBL. |
| Small Mammals | 0.42 | 7.4 | 0.050 | Arithmetic mean of the 2003/2004 small mammal data collected by BBL. |

Notes:

1. Exposure Point Concentrations (EPCs) represent the arithmetic means of the 2003/2004/2005 BBL RI data, and assume 1/2 the laboratory detection limit for non-detects.
mg/kg = milligrams per kilogram

Because the APA contains a diversity of habitats, wildlife utilization for portions of the APA is expected to be moderate to high within the more natural areas. Bawdy Swamp Creek, a narrow intermittent stream, runs across the south-southwest corner of the Site.

Habitats present within the PBA include mixed hardwood/coniferous forest, tall grass/field, scrub-shrub upland, scrub-shrub wetland, and a mixed emergent/scrub-shrub wetland. The area adjacent to the railroad spur and the former fertilizer pile has become re-vegetated and is characterized by tall grasses and vegetation indicative of a successional old field. Immediately west of the former burial pit (and adjacent to the former fertilizer pile) is a scrub-shrub wetland. Immediately north and west of the scrub-shrub wetland are scrub-shrub upland and hardwood/coniferous mixed forest areas. A gravel pile and a utility right-of-way also exist in the northwestern portion of the PBA. To the east of the burial pit is a broad, flat wetland swale that drains towards the northeast. This wetland is characterized as a mixture of emergent and scrub-shrub marsh. A shallow drainage ditch runs through the wetland, and discharges into another drainage ditch northeast of the railroad. The area east of the mixed emergent/scrub-shrub marsh is characterized by a mixed hardwood/coniferous forest. The habitats present within the PBA form contiguous habitats capable of supporting various species of wildlife.

The Site is surrounded by primarily industrial land uses, but also consists of areas of undeveloped land and several private residences in the vicinity. A set of railroad tracks and an industrial transfer station border the Site along its northern boundary. Crocker Road and Interstate 95 border the Site to the south and east. Preston/Gurley Street, an active granary, and the town of Selma border the Site to the west.

Several threatened/endangered species have been identified within Johnston County. However, based on the individual habitat requirements of these species and the habitats present onsite, it is unlikely that the PBA or the APA provide suitable habitat for these species. None of these species were observed during the site-specific habitat assessment that was conducted in October 2001.

The ecological receptors potentially at risk in the PBA include those species associated with the upland forested areas, marsh, and ditch. The ecological receptors potentially at risk in the APA include those species associated with the old field and forested habitats of the Debris Area, the Former Barren Area, the Former Acid Wash Area, Crocker Road ditch, and Bawdy Swamp Creek. Complete exposure pathways for soil/sediment invertebrates in the PBA and APA are direct contact with surface soil, sediment, and surface water. Complete exposure pathways for avian and mammalian receptors in the PBA and APA are incidental ingestion of soil/sediment and ingestion of contaminated prey.

A summary of the exposure variables and screening levels can be found in the attached risk assessment tables in Part 6 of this ROD.

2.7.2.3 Ecological Effects Assessment

The assessment endpoints for the PBA and APA are:

- Survival and maintenance of normally reproducing populations of soil/sediment invertebrates;
- Survival and maintenance of normally functioning plant communities;
- Survival and maintenance of normally reproducing populations of piscivorous, carnivorous, omnivorous, and insectivorous mammals;
- Survival and maintenance of normally reproducing populations of piscivorous, carnivorous, omnivorous, and insectivorous birds; and
- Survival and maintenance of normally reproducing populations of reptiles and amphibians.

Representative wildlife receptors identified for the Site are the short-tailed shrew, raccoon, long-tailed weasel, American robin, green heron, and screech owl. These species were selected based on the measurement endpoints and represent species that potentially utilize different food items from the Site. For example, short-tailed shrews and robins are expected to feed primarily on soil invertebrates. Raccoons are omnivores, and are expected to eat a variety of animal and non-animal food types. Green herons are expected to eat primarily frogs, and long-tailed weasels and screech owls are expected to eat primarily small mammals.

Potentially complete exposure routes for these species are assumed to be via food consumption and ingestion of soil/sediment. Direct exposure of wildlife via other routes (e.g., dermal contact, ingestion of water) may also occur as a result of activities such as wading, burrowing, and feeding, but the magnitude of exposure via these routes is expected to be insignificant relative to food consumption and ingestion of soil/sediment.

Food web modeling is used in the risk characterization to estimate potential exposure for upper trophic level receptors including birds and mammals. The food web modeling is based on the approach presented in the EPA (1993) *Wildlife Exposure Factors Handbook*. The food web modeling approach uses site-specific data for soil, sediment, and biological tissues to estimate the potential oral dosage (in mg/kg-day) to various receptor species. These dosage estimates are then compared to Toxicological Reference Values (TRVs) to evaluate potential risks.

Small mammal trapping within the APA was conducted for four nights in October 2003. The number of traps set each night steadily increased as additional traps were set to the grid(s): 77 traps (10/13), 117 traps (10/14), 130 traps (10/15), and 142 traps (10/16) (total trap nights = 466). A total of 15 small mammals were caught, including 9 short-tailed shrews, 4 cotton rats, 1 golden mouse, and 1 white-footed mouse. This equals a success rate of 3.2 percent. For the reference area, there was a total of 192 trap nights. A total of 6 small mammals were caught, including 3 short-tailed shrews, 1 harvest mouse, and 2 white-footed mice. This equals a success rate of 3.1 percent. The results of the small mammal trapping indicate that small mammal populations exist within the APA, and that population densities (roughly measured by the relative capture efficiency) are similar to the reference area.

For plants, direct observations from the habitat characterization and supplemental field work do not indicate the presence of stressed vegetation within the APA that may be related to COPC concentrations.

Small mammal trapping within the PBA was conducted for four nights in October 2003 and three nights in May 2004. There was a total of 721 trap nights. A total of 14 small mammals were caught, including 1 short-tailed shrew, 2 cotton rats, 10 white-footed mice, and 1 harvest mouse. This equals a success rate of 1.9 percent. This is slightly lower the success rate of 3.1 percent for the reference area. The lower success rate is likely due to habitat differences within the PBA. Large portions of the PBA are overgrown with an understory of poison ivy, which provides little food value to wildlife, and the reference area contains a larger diversity of understory plants, including grasses and other plant species which provide food for small mammals. Regardless, the results of the small mammal trapping indicate that small mammal populations exist within the PBA, and that relative capture efficiency approaches that from the reference area.

For plants, direct observations from the habitat characterization and supplemental field work do not indicate the presence of stressed vegetation within the PBA that may be related to COPC concentrations.

2.7.2.4 Ecological Risk Characterization

The objective of the Risk Characterization is to use recent site-specific data using a weight-of-evidence approach to evaluate potential ecological risks at the Site. The recent RI data used in this Risk Characterization include soil, sediment, surface water, and biota (tissue) data collected by BBL in 2003, 2004, and 2005. The weight-of-evidence approach includes the following lines of evidence: 1) comparison of soil, sediment, and surface water data to generic benchmarks; 2) food web modeling; and 3) qualitative and semi-quantitative observations for plants and small mammal communities.

For the APA, the RI data exceed the generic ecological benchmarks, most notably for lead in soil. The biological tissue data indicates that bioaccumulation is mostly limited to lead in soil invertebrates. The HQs for lead from the food web modeling are generally greater than 1, which may be indicative of potential ecological risks. The results from habitat characterization (for vegetative communities) and the small mammal trapping indicate functioning ecosystems within the APA, and ecological risks from lead do not appear to be widespread. However, lead concentrations in 18 of the 44 surficial soil samples exceed the site-specific wildlife soil Risk Based Concentration (RBC) for lead (440 mg/kg). Lead concentrations in the RI sediment samples are below the range of site-specific wildlife sediment RBCs for lead. However, sediment samples collected from some drainage features are considered as soil given that water is present only during periods of high rainfall. The soil RBC for lead of 440 ppm will be applied to those drainage features. The following Tables 8 and 9 present the HQ Summary and the RBCs for lead in Soil:

**Table 8**

**Ecological**
**Hazard Quotient Summary - Acid Plant Area**

| | NOAEL-Based HQs | | | LOAEL-Based HQs | | |
|---|---|---|---|---|---|---|
| **Species** | **Arsenic** | **Lead** | **Mercury** | **Arsenic** | **Lead** | **Mercury** |
| **Conservative Exposure Assumptions and USEPA-Recommended TRVs** | | | | | | |
| Shorttail Shrew | 0.3 | 107 | 0.6 | 0.03 | 11 | 0.1 |
| Raccoon | 0.3 | 140 | 0.7 | 0.03 | 14 | 0.1 |
| Longtail Weasel | 0.05 | 26 | 0.5 | 0.005 | 2.6 | 0.1 |
| American Robin | 1.5 | 102 | 0.7 | 0.5 | 10 | 0.1 |
| Green Heron | 0.04 | 1.5 | 0.2 | 0.02 | 0.15 | 0.04 |
| Screech Owl | 0.1 | 23 | 0.3 | 0.05 | 2.3 | 0.05 |
| **Realistic Exposure Assumptions and Alternate TRVs** | | | | | | |
| Shorttail Shrew | 0.3 | 4.4 | 0.6 | 0.03 | 0.4 | 0.06 |
| Raccoon | 0.06 | 1.4 | 0.1 | 0.006 | 0.1 | 0.01 |
| Longtail Weasel | 0.02 | 0.5 | 0.2 | 0.002 | 0.05 | 0.02 |
| American Robin | 0.1 | 8.0 | 0.006 | 0.04 | 0.8 | 0.003 |
| Green Heron | 0.010 | 0.39 | 0.006 | 0.004 | 0.04 | 0.003 |
| Screech Owl | 0.03 | 5.6 | 0.007 | 0.01 | 0.6 | 0.004 |

Notes:

1. Hazard quotients (HQs) are calculated as the potential average daily dose (in mg/kg-day) divided by the toxicological reference value (in mg/kg-day).

**Table 9**

**Ecological**
**Risk-Based Soil Concentrations for Lead - Acid Plant Area**

| Species | NOAEL-Based Soil RBCs (mg/kg dry weight) | LOAEL-Based Soil RBCs (mg/kg dry weight) | Average Soil RBC [2] (mg/kg dry weight) |
|---|---|---|---|
| **Conservative Exposure Assumptions and USEPA-Recommended TRVs** | | | |
| Shorttail Shrew | 30 | 300 | 90 |
| Raccoon | 38 | 380 | 120 |
| Longtail Weasel | 160 | 1,600 | 500 |
| American Robin | 39 | 390 | 120 |
| Screech Owl | 150 | 1,500 | 470 |
| **Realistic Exposure Assumptions and Alternate TRVs** | | | |
| Shorttail Shrew | 740 | 7,400 | 2,340 |
| Raccoon | 3,700 | 37,000 | 11,700 |
| Longtail Weasel | 7,800 | 78,000 | 24,700 |
| American Robin | 140 | 1,400 | 440 |
| Screech Owl | 610 | 6,100 | 1,900 |

Notes:

1. Risk-based concentrations (RBCs) for lead in soil were back-calculated using the food web models and are based on a hazard quotient (HQ) of 1.
2. The average RBC represents the geometric mean of the NOAEL-based RBC and the LOAEL-based RBC for each receptor.

TRVs = Toxicity Reference Values
NOAEL = No-Observed-Adverse-Effects-Level
LOAEL = Lowest-Observed-Adverse-Effects-Level
mg/kg = milligrams per kilogram

For the PBA, the RI soil, sediment, and surface water data exceed the generic ecological benchmarks for DDT (and metabolites). Biological tissue data indicate that substantial bioaccumulation is not occurring, and concentrations are generally in the single parts per billion (ppb). The HQs from the food web modeling indicate no ecological risks. Similarly, the results from habitat characterization (for vegetative communities) and the small mammal trapping indicate functioning ecosystems within the PBA, and ecological impacts from pesticides are not apparent. DDT concentrations in both the surficial soil and sediment samples are below the site-specific wildlife RBCs for soil and sediment (464 and 338 mg/kg, respectively).

There are several sources of uncertainty associated with the Risk Characterization. For example, the ecotoxicological benchmarks are generic screening values. The benchmarks are generally conservative in nature so that constituents below the values are generally regarded as posing no risk. Concentrations exceeding the benchmarks are not evidence that ecological risks are occurring, but merely indicate that additional studies may be warranted. For these reasons, a series of site-specific studies were conducted at the Site.

Although site-specific bioaccumulation data is used in the food web modeling to estimate exposure point concentrations, additional uncertainty is associated with the assumptions required for exposure variables (e.g., food intake rate, dietary preference) and TRVs. To reduce the overall level of uncertainty, a range of exposure assumptions and TRVs are used to estimate Site risks (in the form of HQ values).

Another source of potential uncertainty is the selection of measurement endpoints and risk questions that provide the focus of the Risk Characterization. Specifically, endpoints for some species (e.g., reptiles/amphibians) are generally not developed well enough for risk assessment purposes. However, ecological risk assessments cannot take into consideration every species that could possibly occur at the Site (EPA, 1989), and therefore surrogate species should be considered. For these reasons, possible risks for these receptors are inferred from the lines of evidence for analogous receptors (e.g., birds and small mammals).

### 2.7.3 Basis for Action

Action is warranted at this Site because it is possible that the blood lead level in a developing fetus of a future pregnant onsite worker could exceed the target level of 10 $\mu$g/dL. The results of the ALM indicate that in order to ensure that the blood lead level in a developing fetus of a hypothetical future female Site worker remains at or below 10 $\mu$g/dL, the lead concentration in soil should not exceed 665 ppm (assuming a heterogeneous group of potential Site workers).

In addition, there is the potential for unacceptable risk to environmental receptors. HQs are greater than one for environmental receptors due to lead concentrations in surficial soil. These HQs are greater than 1 over a range of exposure assumptions and TRVs. A site-specific wildlife soil RBC for lead of 440 mg/kg was calculated using realistic exposure assumptions and alternative TRVs (see Attached Risk Assessment Tables in Part 6). The final soil clean-up levels

will be the lower of the two risk based values described in this section. Therefore, the site specific action level (SSAL) for soil clean-up for lead is 440 mg/kg.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

## 2.8 Remedial Action Objectives

Remedial Action Objectives (RAOs) consist of media-specific goals for protecting human health and the environment. The HHRA and the ERA identified that only lead in APA soil poses a potential risk to human health and the environment. However, arsenic is present in groundwater and soil; it is likely that soil acts as a source of groundwater contamination. Lead and arsenic are generally co-located in soil, so both contaminants will be addressed by the selected remedy. Both the risk of soil exposure and leaching of contaminants from soil to groundwater will be improved by implementing the selected remedy.

The RAOs were developed as appropriate to abate, prevent, minimize, stabilize, mitigate, and/or eliminate the release or threat of release of Site constituents. These objectives will be achieved by meeting specified clean-up levels. RAOs have been developed for APA soil and APA and PBA groundwater and are described below. Figure 6 shows the approximate location of soil which exceeds the action level/clean-up goal of 440 ppm for lead. "Applicable" or "Relevant and Appropriate" requirements (ARARs) developed for the selected remedy at the Site are included in Tables 13-15.

*APA Soil – Human Health*

Prevent potential human exposure (dermal contact, ingestion, and inhalation) to lead in soil that is present above clean-up levels. Prevent migration of lead from soil to groundwater that would result in groundwater concentrations in excess of ARARs or which might otherwise present an unacceptable risk.

*APA Soil – Protection of the Environment*

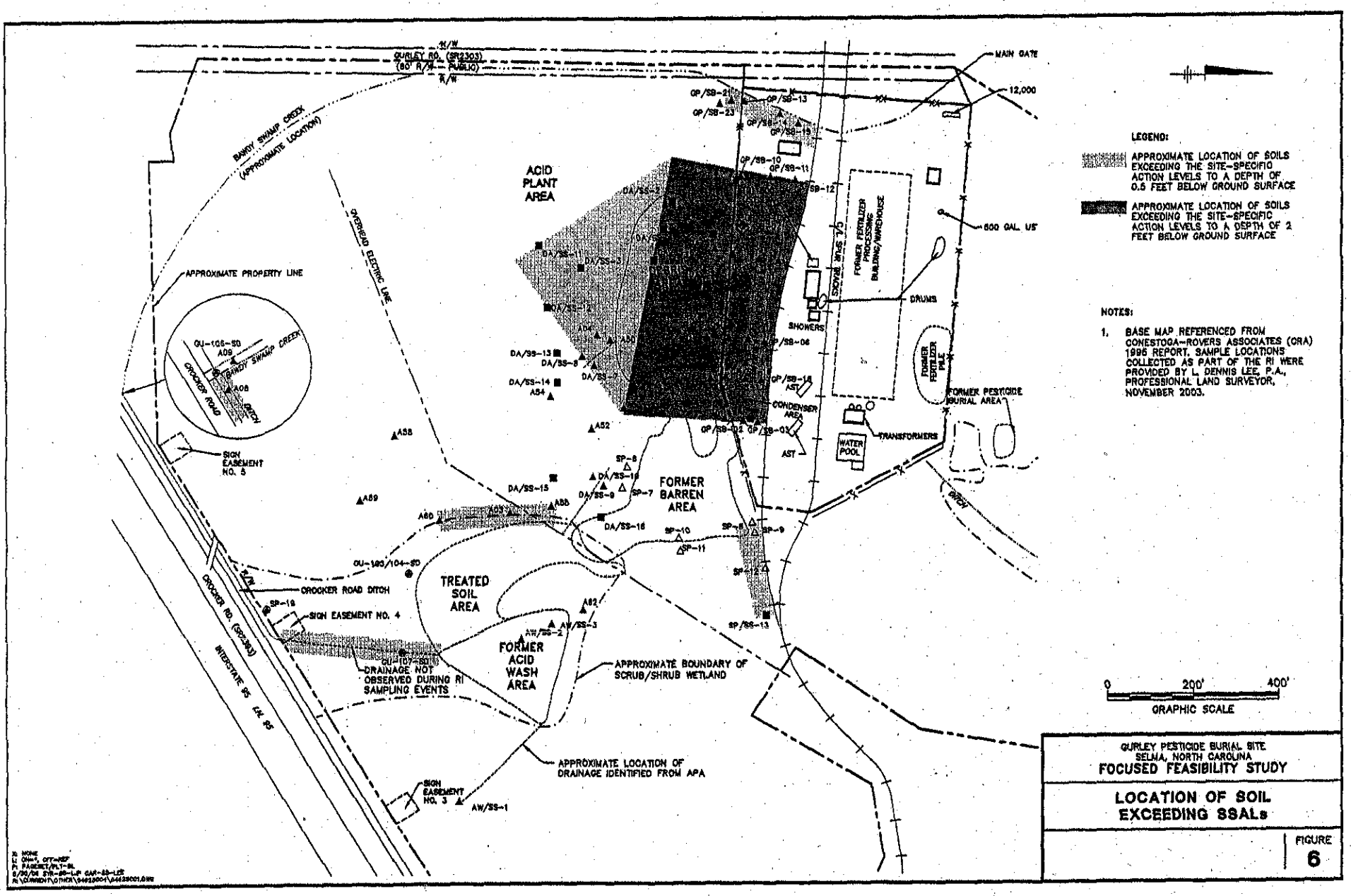
Prevent migration of lead from soil to groundwater and/or sediment that would result in groundwater concentrations in excess of ARARs or present an unacceptable risk in groundwater and/or sediment. Prevent potential exposure to lead in soil above clean-up levels.

*APA and PBA Groundwater – Human Health*

Prevent potential human exposure (dermal contact, ingestion, and inhalation) to groundwater with contaminants (arsenic, lead, benzene,1,2'-dichloropropane, 4,4'-DDD, 4,4'-DDT, alpha-chlordane, fluoride, heptachlor epoxide, lindane) that may exceed ARARs.

*APA and PBA Groundwater – Protection of the Environment*

Restore groundwater quality to achieve groundwater ARARs.




GURLEY PESTICIDE BURIAL SITE
SELMA, NORTH CAROLINA
FOCUSED FEASIBILITY STUDY

## LOCATION OF SOIL EXCEEDING SSALs

FIGURE
6

## 2.9 Description of Alternatives

Four alternatives were evaluated for Site soil and four alternatives were evaluated for Site groundwater.

### 2.9.1 Description of Remedy Components

2.9.1.1 Soil Alternatives

Alternative 1 - No Action

The No Action Alternative was evaluated as a baseline option for comparison to the other alternatives. Under this Alternative, no remedial action would be performed. Contaminated soil and sediments would be left in place and will continue to be a source for migration of the contaminants of concern into groundwater and surface water. Any reduction in soil or sediment contaminant concentrations would be due to natural dispersion, attenuation, and degradation processes.

Alternative 2 - Remove Debris, Install Exposure Barrier over Impacted Soil with Institutional Controls

Installation of an onsite lower permeability exposure barrier would include covering the soil targeted for remedial action. The exposure barrier would consist of an appropriate lower permeability material that would be consistent with potential future redevelopment of the Site. Possible exposure barrier materials include compacted soil, asphalt, concrete, or other comparably effective materials. The size of the exposure barrier would be sufficient to cover the designated area and designed such that erosion resulting from stormwater runoff is minimized. This Alternative also includes removal of debris within the APA with offsite disposal prior to the installation of the engineered barrier. Institutional controls would be implemented to limit future use of the capped area and previously treated areas, as well as to prevent future residential use of the Site if soil remains above the NCDENR Inactive Hazardous Sites Program remedial soil screening goals (including 400 ppm for lead) for unlimited use and unrestricted exposure.

Alternative 3 - Remove Debris, Soil Stabilization, and Install Exposure Barrier over Impacted Soil with Institutional controls

This Alternative is identical to Soil Alternative 2 with the addition of a soil stabilization component for areas with lead contamination targeted for remediation. Onsite stabilization includes the stabilization of lead in soil (as needed) to reduce its leachability to target levels. Stabilization may consist of ex-situ or in-situ solidification/stabilization methods using a proprietary stabilization reagent (e.g., Maectite® or Enviro-Blend®). Stabilized soil, as well as remaining soil targeted for remediation that does not require stabilization, will be covered with an exposure barrier as described in Soil Alternative 2. Institutional controls would be

implemented to limit future use of the capped area and previously treated areas, as well as to prevent future residential use of the Site if soil concentrations remain above the NCDENR Inactive Hazardous Sites Program remedial soil screening goal of 400 ppm for unlimited use and unrestricted exposure.

Alternative 4 - Remove Debris, Excavate Impacted Soil, and Dispose Offsite

This Alternative includes the excavation of soil targeted for remediation with offsite disposal at a permitted Resource Conservation and Recovery Act (RCRA) Subtitle D landfill. Excavated areas would be backfilled with clean soil fill and topsoil. The areas will be graded to ensure proper drainage, and grass grown to control erosion. Excavated soil would be stabilized onsite as necessary to facilitated disposal at a RCRA Subtitle D facility. Stabilization may consist of ex-situ or in-situ solidification/stabilization methods using a proprietary stabilization reagent (e.g., Maectite® or Enviro-Blend®). This Alternative also includes removal of debris within the APA with offsite disposal. Institutional controls would be implemented to limit future use of the Site, specifically the previously treated areas, and to prevent future residential use of the Site if soil concentrations remain above the NCDENR Inactive Hazardous Sites Program remedial soil screening goal of 400 ppm for unlimited use and unrestricted exposure.

2.9.1.2 Groundwater Alternatives

Alternative 1 - No Action

Under the No Action Alternative, no remedial actions would be implemented. Contaminated groundwater would be left in place without treatment allowing continued migration of the contaminants of concern. Any reduction in groundwater concentrations would be due to natural migration, dispersion, attenuation, and degradation processes.

Alternative 2 - Monitored Natural Attenuation with Institutional controls

Monitored natural attenuation of shallow groundwater would consist of annual groundwater monitoring across the Site. In combination with a soil alternative that would eliminate the future sources of lead and arsenic to groundwater, this Alternative would monitor the anticipated diminishing concentrations of arsenic and lead in the groundwater over time as well as compliance with the ARARs. Institutional controls would be implemented to prevent the installation of drinking water wells if groundwater remains above the NCDENR 2L Standards for both the APA and PBA analytes.

Alternative 3 - Permeable Reactive Barrier with Institutional controls

Containment and treatment of groundwater under Groundwater Alternative 3 would include in-situ geochemical treatment using a Permeable Reactive Barrier (PRB) that would reduce the solubility and mobility of contaminants in the groundwater. The PRB technology involves the placement or formation of a reactive treatment zone in the path of a dissolved

contaminant plume such that target contaminants are removed or altered by physical, chemical, and/or biological means. Treatment occurs in-situ and is generally passive in nature. The barrier would be installed at the downgradient perimeter of the impacted groundwater such that the target contaminant plume will enter the wall under a natural hydraulic gradient. The plume is thereby captured and treated, and regulatory concentration goals are achieved at a designated down-gradient point of compliance. This Alternative would include monitoring the anticipated diminishing concentrations of arsenic and lead in the groundwater over time as well as compliance with the ARARs. Institutional controls would be implemented to prevent the installation of drinking water wells if groundwater remains above the NCDENR 2L Standards.

Groundwater 4 - Groundwater Extraction and Treatment System with Institutional controls

Containment and treatment of groundwater under Groundwater Alternative 4 would include extraction and ex-situ treatment that would remove the contaminants from the groundwater and prevent their migration offsite. The extraction and treatment technology involves the installation of groundwater extraction wells to prevent offsite migration and an onsite ex-situ groundwater treatment system such that target contaminants are captured through a groundwater extraction trench or series of wells, then removed or altered by physical, chemical, and/or biological means. Treatment occurs ex-situ and is performed by an active system that requires ongoing maintenance. Residuals resulting from the groundwater treatment system will require management and offsite disposal. The groundwater extraction trench or wells would be installed at the downgradient perimeter of the impacted groundwater such that the target contaminant plume will be captured and treated, and regulatory concentration goals and compliance with ARARs are achieved at a designated down-gradient point of compliance. Institutional controls would be implemented to prevent the installation of drinking water wells if groundwater remains above the NCDENR 2L Standards.

### 2.9.2 Common Elements and Distinguishing Features of Each Alternative

Alternative 1 for each of the media (soil and groundwater) is the No Action Alternative. This Alternative includes the 5-year review which would be required if this Alternative is chosen.

Alternatives 2, 3 and 4 for soil and 2, 3, and 4 for groundwater include Institutional Controls to limit future use of the capped area and groundwater.

Alternatives 2 and 3 for **soil** include the installation of a lower permeability exposure barrier to cover the impacted soil on the Site. The treatment of the soil varies between the two Alternatives, because the soil in Alternative 3 would be stabilized before capping. Both alternatives would require 5-year reviews. Alternatives 3 and 4 for soil would include the stabilization of soil.

Alternatives 3 and 4 for **groundwater** would both be active measures to treat groundwater contamination. Alternative 3 requires the installation of an in-situ permeable

reactive barrier. Alternative 4 would require installing extraction wells and pumping the water from the aquifer until the groundwater clean-up goals are achieved.

### 2.9.3 Expected Outcomes of Each Alternative

All No Action alternatives would leave the Site as presenting the same risks as are currently present. Contamination migration would be expected to continue.

#### 2.9.3.1 Soil Alternatives

Alternative 2 would be protective of human health and the environment by consolidating and/or covering select lead-containing soil beneath an onsite exposure barrier. Institutional controls would be necessary under this Alternative because soil containing lead above the clean-up level of 440 ppm, noted in Section 2.12.4.2, would remain at the Site under the cap.

Soil Alternative 3 would be protective of human health and the environment by removing, stabilizing, and/or covering select lead-containing soil beneath an onsite exposure barrier. Institutional controls would be necessary under this Alternative because soil containing lead above the clean-up level noted in Section 2.12.4.2 would remain at the Site.

Alternative 4, Excavation and Offsite Disposal, would return the Site to industrial/commercial use for the soil media. Institutional controls may be necessary to preclude residential use, depending upon the results of post removal confirmation sampling. The risks to human and ecological receptors would be reduced to acceptable levels.

#### 2.9.3.2 Groundwater Alternatives

Alternative 2 would be protective of human health and the environment if paired with an appropriate soil alternative that minimizes the potential for an ongoing source of contaminants to groundwater. Natural attenuation will reduce onsite groundwater to ARARs over time. Institutional controls would be implemented to prevent the installation of drinking water wells if groundwater remains above the NCDENR 2L Standards.

Alternative 3 would be protective of human health and the environment by treating and removing arsenic- and lead-containing groundwater. Institutional controls would be implemented to prevent the installation of drinking water wells if groundwater remains above the NCDENR 2L Standards. This Alternative would minimize the potential for human exposure and offsite migration by construction of the PRB and treatment of groundwater containing arsenic and lead. Subsequently, onsite groundwater would attenuate over time.

Groundwater Alternative 4 would be protective of human health and the environment by treating and removing arsenic- and lead-containing groundwater as it prevents impacted groundwater from moving offsite. Institutional controls would be implemented to prevent the installation of drinking water wells if groundwater remains above the NCDENR 2L Standards.

This Alternative would minimize the potential for human exposure and offsite migration by construction of the groundwater extraction and treatment system for treating groundwater containing arsenic and lead.

## 2.10 Comparative Analysis of Alternatives

In this section, each alternative is evaluated using the nine evaluation criteria required in Section 300.430(f)(5)(i) of the NCP.

### 2.10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

#### 2.10.1.1 Soil Alternatives

Soil Alternative 1 is the least protective of human health and the environment of all four alternatives. Soil Alternative 1 provides no increased protection over the current conditions and would not be protective of human health and the environment over the long-term for foreseeable land uses. Removing select soil and consolidating under an exposure barrier (Soil Alternative 2) would be protective of human health and the environment by minimizing the potential for human exposure with soil and uncontrolled offsite migration by implementing erosion control measures, a cover system, institutional controls, and maintenance. Select soil will be stabilized under Soil Alternative 3 to minimize leaching of lead to groundwater; however, lead-containing soil would remain at the Site both in Soil Alternatives 2 and 3. Soil Alternative 4, in the long term, would be the most protective of human health and the environment by removal and disposal of lead-containing materials above the clean-up level noted in Section 2.12.4.2. Because of its scale, Soil Alternative 4 poses the greatest short-term risks arising from accidental or incidental exposure associated with excavation of the greatest amount of soil, increasing chances of accidental releases, and potential exposure arising out of more than 1,500 trucks traveling to and from the Site to dispose of soil. Overall, Soil Alternative 4 would offer the greatest protection of human health and the environment.

#### 2.10.1.2 Groundwater Alternatives

Groundwater Alternative 1 is the least protective of human health and the environment of all four alternatives unless paired with an appropriate soil alternative. Groundwater Alternative 1 alone provides no increased protection over the current conditions and would not be able to evaluate the protectiveness of human health and the environment over the long-term without monitoring. Monitored natural attenuation with institutional controls (Groundwater Alternative 2) is protective of human health. Groundwater Alternatives 3 and 4 would be protective of the environment in the long-term by reducing the dissolved arsenic and lead concentrations in

groundwater through active treatment. While Groundwater Alternatives 2, 3, and 4 are protective of human health, Groundwater Alternatives 3 and 4 would potentially offer greater protection of human health and the environment due to an additional level of containment and the extraction of contaminated groundwater in Alternative 4. However, Alternative 3 requires more intrusive activity and Alternatives 3 and 4 produce additional residual waste requiring offsite disposal.

### 2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations, which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4). See Part 5: Attached ARARs Tables for potential ARARs for all Soil and Groundwater Alternatives.

#### 2.10.2.1 Soil Alternatives

Alternative 1 would not minimize the potential for exposure to soil containing lead at concentrations exceeding the clean-up level noted in Section 2.12.4.2. Alternatives 2 through 4 would be in compliance with all ARARs.

#### 2.10.2.2 Groundwater Alternatives

Groundwater Alternative 1 alone would not be able to evaluate the potential for exposure to, as well as the potential for offsite migration of, shallow groundwater containing arsenic and lead at concentrations exceeding the clean-up level noted in Section 2.12.4.2. Groundwater Alternative 2 would achieve the ARARs if paired with an appropriate soil alternative that reduces or eliminates continued sources of arsenic and/or lead to groundwater. Groundwater Alternatives 3 and 4 would achieve the ARARs through the installation of groundwater remediation systems.

### 2.10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls. Each alternative, except the No Action Alternative, provides some degree of long-term protection. Because Alternative 1, No Action, for each media does not provide for long-term effectiveness to either human or ecological receptors, it will not be discussed in the following subsections.

#### 2.10.3.1 Soil Alternatives

A primary measure of the long-term effectiveness of an alternative is the magnitude of risk to human health after remediation. With proper and effective operation and maintenance, Soil Alternative 2 would provide long-term effectiveness by isolating lead-containing soil in exceedences of the action levels from the Site while Soil Alternative 3 has a higher degree of long-term effectiveness by stabilizing and isolating lead-containing soil. Soil Alternative 4 has the highest degree of long-term effectiveness and permanence because soil containing lead above the clean-up level noted in Section 2.12.4.2 is excavated and removed from the Site and disposed of in a RCRA-permitted landfill. Soil Alternatives 2 and 3, excavation, consolidation and containment, also have a high degree of effectiveness, but rely on periodic monitoring and repair to ensure that the integrity of the cover and institutional controls are maintained. Soil Alternative 1 would not be an effective or permanent alternative.

2.10.3.2 Groundwater Alternatives

A primary measure of the long-term effectiveness of an alternative is the magnitude of risk to human health after remediation. Groundwater Alternatives 2, 3, and 4 are effective in reducing the risk to human health with the incorporation of institutional controls to prevent potential future groundwater use. Groundwater Alternative 2 would be effective if paired with an appropriate soil alternative that reduces or eliminates continued sources of arsenic and/or lead to groundwater. With proper and effective operation and maintenance, Groundwater Alternatives 3 and 4 would provide long-term effectiveness by treating groundwater with arsenic and lead concentrations greater than the clean-up levels noted in Section 2.12.4.2. Groundwater Alternatives 3 and 4 (treatment) have a high degree of effectiveness, but rely on periodic monitoring and repair to ensure that the treatment system is maintained. Groundwater Alternatives 3 and 4 have the highest degree of long-term effectiveness and permanence because groundwater containing arsenic and lead above the clean-up levels noted in Section 2.12.4.2 would be treated.

### 2.10.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

2.10.4.1 Soil Alternatives

Soil Alternative 1 would not reduce mobility, toxicity, or volume through treatment. Soil Alternative 2 would reduce the mobility of lead-containing soil by reducing rainfall induced migration by installation of the onsite lower permeability exposure barrier. Soil Alternative 3 would further reduce the mobility of lead-containing soil by stabilizing the lead in the soil and through the installation of the onsite lower permeability exposure barrier. Soil Alternative 4 would have the highest reduction in mobility of lead-containing material of all the alternatives through excavation and offsite disposal of materials in a permitted landfill.

2.10.4.2 Groundwater Alternatives

Groundwater Alternative 1 would not provide the ability to evaluate the potential reduction in mobility, toxicity, or volume. Groundwater Alternative 2 provides no active remediation of groundwater; however, groundwater monitoring would evaluate the natural reduction in mobility, toxicity, and volume of shallow groundwater that contain arsenic and lead over time. Groundwater Alternatives 3 and 4 would reduce the toxicity and volume of arsenic and lead-containing groundwater potentially migrating from the Site through installation of a groundwater remediation system. However, Alternatives 3 and 4 produce residual waste that would require offsite management.

**2.10.5 Short-Term Effectiveness**

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until clean-up levels are achieved.

2.10.5.1 Soil Alternatives

Soil Alternative 1 would be effective in the short-term since no construction activities would be implemented. Soil Alternative 2 would have a higher short-term effectiveness because it involves excavating and moving the smallest amount of soil. Soil Alternative 3 has a lower short-term effectiveness because it involves excavating, moving, and stabilizing a larger volume of soil. Although the use of Site controls and monitoring reduce the potential for short-term impacts, risks increase proportionally with increased handling of materials. Soil Alternative 4 would be the least effective in the short term because it would require excavating approximately 65 times the volume of material of Soil Alternatives 2 and 3, increasing the likelihood of accidental releases. Additionally, transporting approximately 1,500 truck loads of materials over public roads during the excavation period increases the potential exposure to the general public. These factors make Soil Alternative 4 the least effective in the short term.

2.10.5.2 Groundwater Alternatives

Groundwater Alternatives 1 and 2 would be effective in the short term since under these alternatives no construction activities would be implemented. Although the use of Site controls and monitoring reduce the potential for short-term impacts, risks increase proportionally with increased handling of materials. Therefore, Groundwater Alternatives 3 and 4 would be least effective in the short term because they require handling impacted soil during the installation of the active groundwater remediation systems.

**2.10.6 Implementability**

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

#### 2.10.6.1 Soil Alternatives

Soil Alternative 1, no action, would be easiest to implement. The remaining three soil alternatives are based upon proven technologies and are considered technically feasible. The services and material necessary to implement Soil Alternatives 2 through 4 would be available through local vendors or could be readily transported to the Site. The engineering, design, and administrative requirements increase with the complexity of the alternatives. As such, Soil Alternative 4 is the least difficult, followed by Soil Alternative 2, with Soil Alternative 3 being the most difficult and complex. The degree of difficulty in implementing these alternatives increases with the amount of material to stabilize and with the construction and long term maintenance of the lower permeability exposure barrier. Due to the higher complexity of work required for Soil Alternatives 2 and 3, Soil Alternative 4 is considered more implementable.

#### 2.10.6.2 Groundwater Alternatives

Groundwater Alternative 1, no action, would be easiest to implement. The remaining three groundwater alternatives are based upon proven technologies and are considered technically feasible. The services and materials necessary to implement Groundwater Alternatives 2, 3, and 4 would be available through local vendors or could be readily transported to the Site. The engineering, design, and administrative requirements are higher with Groundwater Alternatives 3 and 4 than with Groundwater Alternative 2. Groundwater Alternative 2 is the least difficult followed by Groundwater Alternative 4, with Groundwater Alternative 3 being the most difficult, complex, and least proven. The degree of difficulty in implementing Groundwater Alternatives 3 and 4 increases with the amount of material to be excavated and the difficulty and magnitude of the remediation system to be installed. Due to the magnitude of work required for Groundwater Alternatives 3 and 4, Groundwater Alternative 2 is considered to be the most implementable.

### 2.10.7 Cost

The estimated present worth costs for the alternatives, are presented in the following subsections.

#### 2.10.7.1 Soil Alternatives

Soil Alternative 1 has no associated capital or O&M costs. The estimated total project present worth costs, including contingency and engineering costs, for each alternative are as follows:

- Soil Alternative 2 is $0.9 million (capital costs of $568,100; 30 years of maintenance costs $5,600/year);
- Soil Alternative 3 is $1.1 million (capital costs of $720,600; 30 years of maintenance costs $5,600/year);
- Soil Alternative 4 is $3.1 million (capital costs of $2,129,000; no annual maintenance costs );

2.10.7.2 Groundwater Alternatives

Groundwater Alternative 1 has no associated capital or O&M costs. The estimated total project present worth costs, including contingency and engineering costs, for each alternative are as follows:

- Groundwater Alternative 2 is $0.28 million; (capital costs of $72,000; 30 years of monitoring costs of 10,000/year);
- Groundwater Alternative 3 is $4.1 million (capital costs of $2,677,800; 30 years of monitoring costs $10,000/year);
- Groundwater Alternative 4 is $6.1 million (capital costs of $1,174,000; 30 years of monitoring and maintenance costs of $245,360/year);

### 2.10.8 State/Support Agency Acceptance

NCDENR has been the support agency for this Site. NCDENR has provided a conditional concurrence with the selected remedy (see attached Part 7).

### 2.10.9 Community Acceptance

No written comments were received on the Proposed Plan, and only a few comments were provided in the public meeting. There were no objections to any of the alternatives.

## 2.11 Principal Threat Wastes

The NCP establishes and expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat waste combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile, which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The contaminated soils above the clean-up levels in the Acid Plant Area and the groundwater above the clean-up levels (noted in Section 2.12.4.2) are considered to be "principal threat wastes" because the chemicals of concern are found at concentrations that pose a significant risk to either human or the environment.

The Alternatives described in Section 2.9 (excluding the No Action Alternatives) would address principal threat wastes. Alternative 1, No Action, would not address the principal threats at the Site. Alternatives 2 and 3, would significantly reduce the risks posed by principal threats by limiting exposure. Alternative 4 would significantly reduce the risks posed by principal threats through removal and offsite disposal. Groundwater Alternative 1 would not address principal threat wastes. Groundwater Alternatives 2, 3, and 4 would reduce the risks posed by principal threats, but in varying time frames with Alternative 2 taking the longest amount of time. Groundwater Alternative 3 would reduce risk by providing a barrier to offsite migration of principal threat wastes. Groundwater Alternative 4 would reduce risk by pumping and treating principal threat wastes.

## 2.12 Selected Remedy

### 2.12.1 Description of the Rationale for the Selected Remedy

2.12.1.1 Soil

The Selected Remedy for Soil is Alternative 4, Excavation and Offsite Disposal. Soil Alternative 4 involves the excavation of soil with lead concentrations exceeding 440 ppm (as noted in Section 2.12.4.2) and offsite disposal at a permitted RCRA Subtitle D landfill. Institutional controls to preclude residential use of the Site may be implemented, depending upon the results of the post removal confirmation soil sampling. Soil Alternative 4 will be the most protective of human health and the environment by removing soil with lead concentrations exceeding the clean-up level noted in Section 2.12.4.2 and permanently disposing of it in a RCRA Subtitle D landfill. This Alternative achieves most of the objectives, is the most protective of the alternatives, and offers a balance of effectiveness and cost. The soil remedy is considered cost effective because even though the costs are greater than the other remedies, the selected remedy provides a relatively higher level of long term effectiveness and permanence.

Alternative 1 does not treat or remove the principal threat, and therefore does not reduce Site risks through active treatment. Alternatives 2 and 3 are protective of human health and the environment by covering select lead-containing soil beneath an onsite exposure barrier. These two alternatives, however, would leave soil containing lead above the clean-up levels noted in Section 2.12.4.2 at the Site.

2.12.1.2 Groundwater

The Selected Remedy for Groundwater is Alternative 3, Permeable Reactive Barrier (PRB). Groundwater Alternative 3 includes the construction of a PRB at the Site combined with institutional controls preventing future groundwater use. A PRB involves the placement or formation of a reactive treatment zone in the path of impacted groundwater such that target contaminants are removed or altered by physical, chemical, and/or biological means. Groundwater Alternative 3 will be protective of human health and the environment by treating contaminated groundwater. The groundwater remedy will achieve the clean-up levels noted in

Section 2.12.4.2. Institutional controls will be implemented to prevent the installation of drinking water wells if groundwater remains above the NCDENR 2L Standards.

Alternatives 1 and 2 do not treat or remove the principal threats, and therefore do not reduce Site risks through active treatment. Alternatives 3 and 4 both significantly reduce the risks to human and ecological receptors; however Alternative 3 is significantly less expensive than Alternative 4. In addition, preliminary groundwater modeling indicated that Alternative 2 (monitored natural attenuation) could take 100 years or more to achieve groundwater clean-up levels. The geochemical modeling is based on the PHREEQC model developed by the USGS, and is described further in the FS. While the PRB was described in the FS as being installed at the downgradient edge of the plume, it is likely that some configuration of the PRB deployed in the center of the plume can achieve groundwater clean-up levels in a more reasonable timeframe. Additional groundwater monitoring and evaluation will be performed during the remedial design to arrive at the optimum composition and configuration of the subsurface treatment zone.

### 2.12.2 Description of the Selected Remedy

The selected remedy consists of Soil Alternative 4 (Excavation and Offsite Disposal) and Groundwater Alternative 3 (Permeable Reactive Barrier). Institutional controls to preclude residential use of the Site may be necessary depending upon the results of the post removal soil confirmation sampling. Additional institutional controls to prohibit use of the Site groundwater for drinking water will be necessary until the groundwater clean-up standards have been met. The remedial design, including a treatability study, will be conducted prior to implementation of the groundwater remedy. A detailed description of the selected remedy follows in the sequence that is expected.

#### 2.12.2.1 Step 1 - Groundwater - Monitoring

Groundwater monitoring will be conducted to determine current contaminant concentrations in groundwater prior to the excavation of soil as described in Step 2. If water is present in drainage features from the APA, then surface water samples will also be collected and analyzed. Additional soil samples will also be collected from the areas to be excavated and analyzed for total and TCLP arsenic and lead.

#### 2.12.2.2 Step 2 – Soil - Excavation and Offsite Disposal

This alternative involves the excavation of soil with lead concentrations exceeding 440 ppm with offsite disposal at a permitted RCRA Subtitle D landfill. The estimated volume of soil to be excavated, approximately 17,000 in-place cubic yards, is based on an expected depth of about 2 feet bgs. This area includes the areas around samples such as GU-107-SD and A08, which are described in the RI Report as having a designation of both surface soil and sediment as those areas are occasionally inundated with water. However, because these samples are located in areas that are only infrequently inundated with water, these areas are considered to be soil and are included with the soil to be removed under this remedy.

The approximate extent of soil to be excavated is shown on Figure 5. Additional sampling will be conducted (e.g., west of sample location SA/SS-12) prior to excavation to further delineate/refine the extent of soil to be excavated. Confirmation samples will be collected from the excavation areas to confirm that the average lead concentration for each 0.25-acre area excavated is below the clean-up level noted in Section 2.12.4.2, and that no remaining individual sample contains lead at concentrations greater than 1,000 mg/kg. (This averaging approach was discussed in the FS relative to evaluating the risk to humans. However, the post-excavation residual contaminant concentrations to remain in soil will need to be evaluated during the design phase to account for ecological risk and to further evaluate the potential leaching or migration of contaminants from soil to groundwater.)

It is not currently anticipated that dewatering of the excavation areas will be necessary. However, the need for dewatering is possible depending upon Site conditions at the time of the clean-up and the final depth of excavation. The remedial design or remedial action planning documents will further evaluate appropriate dewatering techniques and associated water treatment and discharge requirements.

Lead and arsenic in the excavated soil will be stabilized as needed to reduce the leachability of these metals to levels that will facilitate acceptance of the soil at a RCRA Subtitle D landfill. Pending approval of the waste profile by the landfill, stabilized soil will have leachable arsenic and/or lead concentrations that are below the following standards:

Arsenic = 5.0 mg/L TCLP; and
Lead = 5.0 mg/L TCLP.

The Universal Treatment Standards (UTS's) for lead and arsenic are 0.75 mg/L TCLP and 5.0 mg/L TCLP respectively. However, based on the federal alternative treatment standards for soil (promulgated at 40 CFR 268.49), which states that successful treatment of a characteristically hazardous soil requires that the characteristic be eliminated and that the underlying hazardous constituents (UHCs) are reduced by 90%, or to concentrations less than ten times the UTS's. Therefore, the alternative treatment standards for soil at this site are 7.5 mg/L TCLP for lead and 50 mg/L TCLP for arsenic. However, since this soil is to be disposed of at a Subtitle D Landfill, the TCLP limits of 5.0 mg/L for lead and arsenic apply. Therefore, 5.0 mg/L TCLP for lead and arsenic will be used as the standard for treatment at the site. However, the final treatment standard will be determined by the landfill after its review of the waste profile.

Excavated areas will be backfilled with clean soil fill and topsoil, the areas graded to ensure proper drainage, and grass grown to control erosion. Lime will be added to the bottom of the excavation prior to backfilling as appropriate to reduce the mobility of residual lead in the soil. Institutional controls will also prevent future residential use of the Site if post removal soil confirmation sampling results remain above the NCDENR Inactive Hazardous Sites Program remedial soil screening goal of 400 ppm for unlimited use and unrestricted exposure.

Air monitoring in the work zone and at the site perimeter will be performed in accordance with the health and safety plan to be developed as part of the RD/RA planning documents.

2.12.2.3 Step 3 - Groundwater – Monitoring and Design of PRB

Groundwater monitoring will be conducted to determine contaminant concentrations in groundwater after the excavation of soil as described in Step 2. Additionally, treatability studies and pilot studies will be conducted to determine the best placement and material content of the PRB. Additional wells will be installed as necessary to further evaluate the extent of groundwater contamination in the shallow and deep groundwater.

2.12.2.4 Step 4 - Groundwater - Permeable Reactive Barrier and Monitoring

Conceptually, the barrier wall will be installed on the southern portion of the Site and will be approximately 400 feet in length. The PRB will be approximately 35 feet deep (tied into the intermediate confining unit) and approximately 5 feet wide. The reactive material may consist of approximately 10% zero valent iron, 65% gravel, 20% compost, and 5% limestone. In addition, cutoff walls will be installed on either side of the extraction trench to funnel groundwater into the treatment area. Geochemical modeling of Site groundwater indicates that neutralization of the lower pH in groundwater is the most significant factor in COPC treatment. The precise method and material to be used to create the reactive zone that will be used to increase groundwater pH and otherwise treat groundwater will be evaluated further in the design phase. Prior to implementation of a PRB, treatability studies will be conducted to determine the appropriate composition and configuration of reactive material. Approximately three shallow and three deep monitoring wells will be installed to monitor the effectiveness of the Alternative. One well pair will be installed upgradient and two pairs will be installed along the downgradient perimeter of the PRB. Existing wells will be abandoned if not needed for future monitoring activities. Long term groundwater monitoring will be performed to assess the effectiveness of the PRB in treating groundwater to clean-up levels (noted in Section 2.12.4.2) and compliance with ARARs. Surface water monitoring will also be included as part of the long term monitoring plan.

2.12.2.5 Step 5 – Institutional Controls

EPA Institutional Controls (ICs) guidance (EPA 2000) recommends four specific factors be considered when documenting the ICs to be implemented at a Site: Objective, Mechanism, Timing and Responsibility. The following is a listing of these factors relative to the Gurley Pesticide Site.

1. **Objective:** The objective of the ICs is to assist the active portion of the selected remedy (i.e., the excavation and off-site disposal) in preventing and/or managing potential human exposure to soil contamination that meets the clean-up levels based on industrial use but which may still be above levels that would allow future residential use. The ICs will also keep property that has been remediated to non-residential clean-up levels from reverting

to another use designation (e.g., residential) without proper remediation to satisfy any proposed non-industrial use. Another objective of the ICs is prevent the installation of drinking water wells on the Site until groundwater clean-up levels have been met. A final objective is to require a consultation with EPA and/or NCDENR before any future construction activities are undertaken in the area of contamination.

2. **Mechanism:** The remedy relies on ICs to achieve the objectives noted above. ICs are non-engineered instruments, such as administrative and/or legal controls, that help to minimize and/or manage the potential for human exposure to contamination and/or protect the integrity of a remedy. The following are general explanations of the four categories of IC mechanisms available for use followed by those controls to be used for the Gurley Pesticide Site:

- *Proprietary Controls* - These controls are based on State law and use a variety of tools to prohibit activities that may compromise the effectiveness of the remedy or restrict activities or future uses of resources that may result in unacceptable risk to human health or the environment. They may also be used to provide site access for operation and maintenance activities. The most common examples of proprietary controls are easements and covenants.
- *Governmental Controls* - These controls impose land or resource restrictions using the authority of an existing unit of government. Typical examples of governmental controls include zoning, building codes, drilling permit requirements and State or local groundwater use regulations.
- *Enforcement and Permit Tools with IC Components* - These types of legal tools include orders, permits, and consent decrees. These instruments may be issued unilaterally or negotiated to compel a party to limit certain site activities as well as ensure the performance of affirmative obligations (e.g., to monitor and report on an IC's effectiveness).
- *Informational Devices* - These tools provide information or notification about whether a remedy is operating as designed and/or that residual or contained contamination may remain on-site. Typical information devices include State registries, deed notices, and advisories.

For the Gurley Pesticide Site, Institutional Controls will include the following:

*Proprietary Control* – The Site will have restrictions placed on the Site property deed via restrictive covenants that run with the land to notify future interested parties or owners of the presence of contaminated soil and to limit future use of the Site to non-residential uses. The restrictions will also prohibit the installation of drinking water wells at the Site. The prohibition against residential use will be contingent upon the results of soil confirmation sampling after the soil remedy has been implemented. For the State to agree with future residential use, the contaminant concentrations in soil must be below

the NCDENR Inactive Hazardous Sites Program remedial soil screening goals (including lead concentrations of 400 ppm for unlimited use and unrestricted exposure). The ICs will also require consultation with EPA and/or NCDENR before any future construction in the area of soil or groundwater contamination as described in this ROD.

The deed restrictions are the preferred type of institutional controls for this Site. However, if deed restrictions cannot be achieved, then other types of ICs, as noted above, may be used.

3. **Timing:** The Institutional Controls must be explained in the Remedial Design (RD) and the Operations and Maintenance (O&M) Plan. These controls must stay in place as long as soil contamination remains at levels that would not allow unrestricted land use or as long as groundwater contamination remains above the final clean-up levels.

4. **Responsibility:** The PRPs will be responsible for implementing the ICs including any property surveys, fees, etc., needed for the ICs. The PRPs will prepare O&M Reports or similar status reports such as an IC Implementation Report that summarizes all ICs implemented for the Site. EPA is responsible for monitoring (e.g., in O&M Report, in IC Implementation Report, during the 5 year reviews, etc.) the implementation and effectiveness of the ICs.

### 2.12.3 Summary of the Estimated Remedy Costs

The selected remedy for soil is expected to cost approximately $3.1 million as shown in Table 10. The selected remedy for groundwater is expected to cost $4.1 million as shown in Table 11. The total cost of the remedy is expected to be $7.2 million.

**Table 10: Estimated Costs for Selected Soil Remedy**

| Item No. | Description | Estimated Quantity | Unit | Unit Price Material & Labor | Estimated Amount |
|---|---|---|---|---|---|
| 1 | Mobilization/Site Preparation/Demobilization | 1 | LS | 100,000 | $75,000 |
| 2 | Debris Removal | 4,500 | TON | 25 | $112,500 |
| 3 | Clearing/Grubbing | 5 | AC | 6,200 | $31,000 |
| 4 | Soil Excavation and Loading (based on investigation results) | 17,000 | CY | 15 | $255,000 |
| 5 | Soil Stabilization (as needed) | 6,375 | TON | 20 | $127,500 |
| 6 | Offsite Disposal to a Subtitle D Landfill | 25,500 | TON | 40 | $1,020,000 |
| 7 | Site Restoration of Excavated Areas | | | | |
| | Install Clean Fill Including Backfill and Compaction | 9,000 | CY | 27 | $243,000 |
| | Install Topsoil | 8,000 | CY | 28 | $224,000 |
| | Hydroseeding | 8 | AC | 2,000 | $16,000 |
| 8 | Implementation of Institutional Controls | 1 | LS | 25,000 | $25,000 |
| | | | | **SUBTOTAL CAPITAL COSTS:** | **$2,129,000** |

| | | | |
|---|---|---|---|
| | Contingency | 30% | $638,700 |
| | Engineering | 15% | $319,350 |
| | | **TOTAL:** | **$3,087,050** |
| **APPROXIMATE TOTAL PRESENT WORTH COSTS FOR SOIL REMEDY** | | | **$3,100,000** |

## Table 11: Estimated Costs for Selected Groundwater Remedy

| Item No. | Description | Estimated Quantity | Unit | Unit Cost ($) | Item Cost($) |
|---|---|---|---|---|---|
| 1 | Mobilization/Site Preparation/Demobilization | 1 | LS | 100,000 | $100,000 |
| 2 | Treatability Study | 1 | LS | 75,000 | $75,000 |
| 3 | Trenching | 400 | LF | 300 | $120,000 |
| 4 | Disposal of Soil Removed from Trench Excavation | 3,900 | TON | 40 | $156,000 |
| 5 | Reactive Materials | | | | |
| | 10% Zero Valent Iron | 260 | CY | 1,630 | $423,800 |
| | 20% Compost | 520 | CY | 50 | $26,000 |
| | 65% Gravel | 1,690 | CY | 45 | $76,100 |
| | 5% Limestone | 130 | CY | 70 | $9,100 |
| | Clay/geotextile/gravel cover over trench | 400 | LF | 2 | $800 |
| 6 | Deep Monitoring Well Installation | 3 | Each | 4,000 | $12,000 |
| | Shallow Monitoring Well Installation | 3 | Each | 3,000 | $9,000 |
| 7 | Cutoff Walls | 17,500 | SF | 30 | $525,000 |
| 8 | Replacement of Reactive Media | | | | |
| | Replacement of Reactive Media at 15 Years | 1 | Event | 600,000 | $600,000 |
| | Disposal of Reactive Media at Subtitle D Landfill | 13,000 | TON | 40 | $520,000 |
| 9 | Implementation of Institutional Controls | 1 | LS | 25,000 | $25,000 |
| | | | | **SUBTOTAL CAPITAL COSTS:** | **$2,677,800** |
| 10 | Annual Groundwater Monitoring | 1 | Event | 10,000 | $10,000 |
| | | | | **SUBTOTAL ANNUAL COSTS** | **$10,000** |
| | | | | **30-YEAR PRESENT WORTH COST (7%):** | **$124,090** |
| | | | | **PRESENT WORTH COST:** | **$2,801,890** |
| | | Contingency | 30% | | $840,567 |
| | | Engineering | 15% | | $420,284 |
| | | | | **TOTAL:** | **$4,062,741** |
| | | | | **GROUNDWATER REMEDY APPROXIMATE TOTAL PRESENT WORTH COST:** | **$4,100,000** |

## 2.12.4 Expected Outcomes of the Selected Remedy

### 2.12.4.1 Available Use after Clean-up

After the remedial action for soil is completed, the property will be available for industrial uses with restrictions on the use of groundwater. There may be prohibitions against residential use, contingent upon the results of soil confirmation sampling after the soil remedy has been implemented. The groundwater will be monitored to determine contaminant concentrations over time. Until the groundwater remedy is complete, restrictions will be required to prevent the Site groundwater from being used for drinking water and to prevent deleterious effects on the movement of contaminated groundwater.

### 2.12.4.2 Final Clean-up Levels

As described in the risk assessment, EPA first identified chemicals of potential concern (COPCs) to develop the clean-up goals at the site. The COPCs are the chemicals whose data are of sufficient quality for use in the quantitative risk assessment, are potentially site-related, are above background concentrations at the site, and represent the most significant contaminants in terms of potential toxicity to humans.

Contaminants of Concern (COCs) are the COPCs that significantly contribute to an exposure pathway that exceeds either a 1x10-4 cumulative site cancer risk or exceeds a non-carcinogenic hazard index of 1. In addition, a contaminant may be retained as a COC if the observed concentration exceeds a state or federal chemical-specific ARAR or if they have the potential to leach to groundwater at levels exceeding a maximum contaminant level (MCL).

Lead is the risk driver from exposure to soil for both humans and environmental receptors. Protective lead clean-up levels for soil were derived using the Adult Lead Model for human receptors and back calculated using food web models (and a Hazard Quotient of 1) for environmental receptors. Further details regarding the derivation of clean-up levels can be found in the respective Human Health and Ecological Risk Assessments. The clean-up goal of 440 ppm for lead in soil at the Site was based on the protection of environmental receptors and was lower than the human health based clean-up goal of 665 ppm. Arsenic and lead are generally co-located in soil so the selected remedy is expected to address both contaminants; as a result, a separate clean-up goal for arsenic was not derived during the FS. The selected remedy is expected to reduce average concentrations of lead in soil by approximately a factor of 10; such a reduction in source material is expected to reduce the leaching of contaminants to groundwater. The relationship between residual contaminant concentrations in soil and potential leaching to groundwater will be further evaluated during the Remedial Design.

Although there is no groundwater consumption at the Site at this time, groundwater at the Site is considered a potential source of drinking water. Therefore, groundwater clean-up levels are based on groundwater ARARs which are based on the protection of human health. The inorganic COCs in groundwater are the focus of the active portions of the selected remedy. The

organic COCs are found in a limited number of wells, but will be addressed by monitoring and ICs. The long term groundwater monitoring data will be periodically reviewed to determine if other actions are necessary.

The Final Clean-up Levels for soil and groundwater are listed below in Table 12.

**Table 12: Final Clean-up Levels**

| MEDIA | CONTAMINANT | CLEAN-UP LEVEL | SOURCE |
|---|---|---|---|
| Soil | Lead | 440 ppm | Ecological Risk Assessment |
| Groundwater | Arsenic | 10 µg/L | Federal Primary Drinking Water Standard |
| | Fluoride | 4 mg/L | Federal Primary Drinking Water Standard |
| | Lead | 15 µg/L | Federal Action Level for Drinking Water |
| | Benzene | 1 ug/l | NCDENR 2L Groundwater Standard |
| | 1,2 dichloropropane | 0.56 µg/L | NCDENR 2L Groundwater Standard |
| | Heptachlor epoxide | 0.0038 ug/l | NCDENR 2L Groundwater Standard |
| | 4,4' DDT | 0.14 µg/L | NCDENR 2L Groundwater Standard |
| | 4,4' DDD | 0.1 µg/L | NCDENR 2L Groundwater Standard |
| | Gamma-BHC (lindane) | 0.2ug/l | NCDENR 2L Groundwater Standard |

#### 2.12.4.3 Anticipated Environmental and Ecological Benefits

Removal of the contaminated soil will improve the quality of the ecological habitat that already exists onsite. Removing the contaminated soil will eliminate the source of contamination and decrease exposure to environmental receptors.

## 2.13 Statutory Determinations

### 2.13.1 Protection of Human Health and the Environment

The selected remedy will adequately protect human health and the environment through treatment, engineering controls, and/or institutional controls (NCP §300.430(f)(5)(ii)). Soil containing lead greater than the clean-up level noted in Section 2.12.4.2, 440 ppm, will be removed from the Site and placed in an offsite landfill. The lead clean-up level of 440 ppm is

protective of both humans and ecological receptors, based on the results of the ALM and the risk assessments. Notices will be placed on the property deed to warn potential property purchasers of potentially contaminated groundwater and prohibitions against its use for drinking water. Institutional controls will be implemented to prevent future residential use of the Site if post removal soil confirmation sampling results remain above the NCDENR Inactive Hazardous Sites Program remedial soil screening goals (including 400 ppm for lead) for unlimited use and unrestricted exposure. The institutional controls will also prohibit the installation of drinking water wells at the Site until groundwater clean-up levels have been achieved.

A subsurface treatment zone, such as a permeable reactive barrier, will be installed to treat groundwater and prevent migration offsite. Groundwater will be monitored to determine the effectiveness of the soil remedy and groundwater remedy. The institutional controls will remain in place until the groundwater achieves ARARs. All of these measures will reduce the risks to both human and ecological receptors. They are not expected to cause unacceptable short-term risks or cross-media impacts.

### 2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Federal and State ARARs that are relevant to the Site and the Selected Remedy are presented below. The clean-up will comply with the substantative requirements of the ARARs, but associated permits are not required for work performed on the Site. The NCDENR Inactive Hazardous Sites Program remedial soil screening goals will be used to evaluate future requests for residential use of the Site property.

**Table 13**
**Applicable or Relevant and Appropriate Provisions of the following Standards, Requirements, Criteria, or Limitations (Chemical-Specific)**

| ARAR | Standard, Requirements Criteria, or Limitations | Description |
|---|---|---|
| 40 CFR 131 | Water Quality Criteria | Sets criteria for water quality based on toxicity to aquatic organisms and human health |
| 40 CFR 141 | National Primary Drinking Water Standards | Establishes health-based standards for public water systems |
| 130A NCAC 311-327 | North Carolina Drinking Water Act | Regulates water systems within the state that supply drinking water that may affect the public health |
| 15A NCAC 2L | North Carolina Drinking Water And Groundwater Standards | Establishes groundwater classifications and water quality standards. Values as noted in "Table 12, Final Clean-up Levels" |
| 15A NCAC 2B.0100 & 0.0200 | North Carolina Water Quality Standards | Establishes groundwater classifications and water quality standards |
| 15A NCAC 2D, 2Q | North Carolina Air Pollution Control Regulations | Regulates ambient air quality and establishes air quality standards |
| 15 NCAC 13A | North Carolina Hazardous Waste Management Rules | Establishes standards for hazardous waste treatment facilities |

## Table 14
## Applicable or Relevant and Appropriate Provisions of the following Standards, Requirements, Criteria, or Limitations (Location-Specific)

| Location | ARAR | Standard, Requirements Criteria, or Limitations | Description |
|---|---|---|---|
| Wetlands | 40 CFR 6.302 | Wetlands and Floodplains Executive Order | Action to minimize the destruction, loss, or degradation of wetlands |
| | Clean Water Act Sections 301, 304, 306, 307, 308, 402, and 403 | Clean Water Act – Water Quality Standards | Standards that apply to discharge of wastewater into surface water bodies |
| | 15A NCAC 2B 0.0200 and 0.0231 | North Carolina Surface Water and Wetland Standards | Water quality standards applicable to surface waters and wetlands in North Carolina |
| Landfill | 15A NCAC 13A | North Carolina Hazardous Waste Management Rules | Location requirements for hazardous waste treatment/storage/disposal facilities |
| | 15A NCAC 13B | North Carolina Solid Waste Management Rules | Siting requirements for solid waste disposal units |
| Site | NC GS 130A-310.8 | Recordation of inactive hazardous waste sites | Deed notice to indicate prior hazardous waste activity at the site |

## Table 15
## Applicable or Relevant and Appropriate Provisions of the following Standards, Requirements, Criteria, or Limitations (Action-Specific)

| ARAR | Standard, Requirements Criteria, or Limitations | Description |
|---|---|---|
| Clean Air Act, 40 CFR 50.6, and 40 CFR 52 Subpart K | Clean Air Act – Air Quality Standards | Management of toxic pollutants and particulate matter in the air |
| 15A NCAC 2D, 2Q | North Carolina Air Pollution Control Requirements | Standards apply to air pollution control air quality and emissions |
| 40 CFR Section 262 or state equivalent | Standards Applicable to Generators of Hazardous Waste | Standards that apply to the generation of hazardous waste |
| 15A NCAC 4 | North Carolina Sedimentation Control Rules | Requirements for prevention of sedimentation pollution |
| 40 CFR Part 264 or state equivalent | Standards for Owners and Operators of Hazardous Waste Treatment, Storage, | Standards applicable to the storage of hazardous waste |

| | | |
|---|---|---|
| | and Disposal Facilities | |
| RCRA Subtitle D 40 CFR 243, 257 | Managing Municipal and Solid Waste | Standards that apply to the disposal of solid waste |
| 40 CFR Part 268 | Land Disposal Restrictions | Standards that restrict the placement of certain wastes in or on the ground |
| 15A NCAC 13B | North Carolina Solid Waste Management Rules | Solid Waste Management Rule |

### 2.13.3 Cost Effectiveness

This section explains how the Selected Remedy meets the statutory requirement that all Superfund remedies be cost-effective. A cost-effective remedy in the Superfund program is one whose "costs are proportional to its overall effectiveness" (NCP §300.430(f)(1)(ii)(D)). The "overall effectiveness" is determined by evaluating the following three of the five balancing criteria used in the detailed analysis of alternatives: (1) Long-term effectiveness and permanence; (2) Reduction in toxicity, mobility and volume (TMV) through treatment; and, (3) Short-term effectiveness. "Overall effectiveness is then compared to cost" to determine whether a remedy is cost-effective (NCP §300.430(f)(1)(ii)(D)).

The selected groundwater remedy is considered cost effective because it is a permanent solution that reduces human health and ecological risks to acceptable levels at less expense than some of the other permanent, risk reducing alternatives evaluated. The soil remedy is considered cost effective because even though the costs are greater than the other remedies, the selected remedy provides a relatively higher level of long term effectiveness and permanence.

### 2.13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable (MEP)

The selected remedy provides permanent solutions for all media and treatment for groundwater. The selected remedy for soil, Excavation and Offsite Disposal, provides for reduction of toxicity, mobility and volume, but not through treatment. Soil will be transported offsite, resulting in a permanent solution. The selected remedy for groundwater, a Permeable Reactive Barrier, provides active treatment of groundwater that will reduce the toxicity and volume of contaminated groundwater.

### 2.13.5 Preference for Treatment as a Principal Element

The selected remedy for groundwater includes treatment. The selected remedy for soil does not include treatment was a principal element, but does include any treatment necessary to allow for the disposal of contaminated soil in a RCRA subtitle D landfill.

### 2.13.6 Five-Year Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a review

will be conducted every five years after construction completion at the Site to ensure that the remedy is, or will be, protective of human health and the environment.

## 2.14 Documentation of Significant Changes from Preferred Alternative of Proposed Plan

The Proposed Plan for the Gurley Pesticide Site was mailed to the community on July 24, 2006. The public comment period was from July 31, 2006, to August 29, 2006. The Proposed Plan identified Soil Alternative 4 (Excavation and Offsite Disposal) and Groundwater Alternative 3 (Permeable Reactive Barrier with Institutional controls) as the Preferred Alternative for remediation. No written comments were received by EPA during the public comment period. EPA reviewed the verbal comments submitted during the public meeting on August 9, 2006, which was transcribed by a court reporter. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

## PART 3: RESPONSIVENESS SUMMARY

No written comments were received during the public comment period. The only comments received were during the public meeting that was held on August 9, 2006. A brief summary of the major comments follow.

One person asked about the potential impact to people living in the area if EPA removes the contaminated soil from the Site. RESPONSE: Efforts will be made to reduce the potential impacts of the Remedy. These efforts include using major roads and potentially the back exit of the Site to remove soil from the Site, applying water to the ground surface when disturbing it, covering trucks to keep material from falling off, requiring workers to wear personal monitors to monitor their personal air quality, and perimeter air monitoring at the Site.

The same person asked about the potential danger to workers at the time that they were working on the Virginia Chemical Company Site. RESPONSE: In this action EPA is dealing with current Site conditions and does not know what workers encountered or were exposed to in their daily jobs in the past.

Another person asked which landfill would be a proper landfill for disposal. RESPONSE: EPA has not picked a landfill for the soil disposal, because the start date of the soil excavation has not been determined.

Another person asked if Exxon-Mobil will pay for the remedy. RESPONSE: Exxon-Mobil and Illinois Cereal Mills will pay for the remedy. The Superfund program is structured so that Responsible Parties pay for the clean up. Exxon-Mobil and Illinois Cereal Mills have indicated that they are willing to do the work.

Another person asked if EPA will do the work or if the Responsible Parties will hire contractors. RESPONSE: The Responsible parties will hire contractors and EPA will provide oversight.

# PART 4: ADMINISTRATIVE RECORD INDEX

[ Draft ]

# Administrative Record Index for the GURLEY PESTICIDE BURIAL SITE

## NCD986172526

## 3.0 REMEDIAL INVESTIGATION (RI)

### 3. 3 Scopes of Work

1. "Scope of Work for the Remedial Investigation and Feasibility Study at the Gurley Pesticide Site," EPA Region IV. (DATE UNKNOWN)

### 3. 4 Work Plans and Progress Reports

1. "Final Remedial Investigation/Feasibility Study Work Plan, Gurley Pesticide Burial Site - Selma, North Carolina," Blasland, Bouck & Lee, Inc. (September 2003)

### 3.10 Remedial Investigation (RI) Reports

1. "Remedial Investigation Report - Gurley Pesticide Burial Site - Selma, North Carolina," Blasland, Bouck & Lee, Inc. (September 2005)

### 3.11 Health Assessments

1. Cross-Reference: "Baseline Human Health Risk Assessment, Gurley Pesticide Burial Site, Selma, North Carolina," Blasland, Bouck & Lee, Inc. (September 2005) [Filed and cited as Appendix F - Baseline Human Health Risk Assessment to entry number 1 of 3.10 REMEDIAL INVESTIGATION (RI) - Remedial Investigation (RI) Reports].

### 3.12 Endangerment Assessments

1. Cross-Reference: "Ecological Risk Characterization, Gurley Pesticide Burial Site, Selma, North Carolina," Blasland, Bouck & Lee, Inc. (September 2005) [Filed and cited as Appendix G - Ecological Risk Characterization to entry number 1 of 3.10 REMEDIAL INVESTIGATION (RI) - Remedial Investigation (RI) Reports].

## 4.0 FEASIBILITY STUDY (FS)

### 4. 8 Interim Deliverables

1. Letter from Geoffrey G. Germann, Blasland, Bouck & Lee, Inc. to Randy Bryant, EPA Region IV (with attachment). Transmitting the Remedial Technologies Screening Technical Memorandum. (March 10, 2006)

### 4. 9 Feasibility Study (FS) Reports

1. "Focused Feasibility Study Report, Gurley Pesticide Burial Site, Selma, Johnston County, North Carolina," Blasland, Bouck & Lee, Inc. (July 2006)

### 4.10 Proposed Plans for Selected Remedial Action

1. "Superfund Proposed Plan Fact Sheet, Gurley Pesticide Site, Selma, North Carolina," EPA Region IV. (July 2006)

## 10.0 ENFORCEMENT

### 10.11 EPA Administrative Orders

1. Administrative Order by Consent for Remedial Investigation/Feasibility Study, In the Matter of Gurley Pesticide Burial Site, Selma, Johnston County, North Carolina, Mobil Oil Corporation, Illinois Cereal Mills, Respondents, Docket No. 98-26-C. (September 28, 1998)

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# Administrative Record Index for the GURLEY PESTICIDE BURIAL SITE

## 13.0 COMMUNITY RELATIONS

### 13. 6 Community Relations Plans

1. "Revised Community Involvement Plan, Gurley Pesticide Burial Site, Selma, Johnston County, North Carolina," EPA Region IV. (July 2006)

### 13. 9 Fact Sheets

1. "Superfund Fact Sheet, Gurley Pesticide Burial Site, Selma, Johnston County, North Carolina," EPA Region IV. (March 2000)
2. Cross Reference: "Superfund Proposed Plan Fact Sheet, Gurley Pesticide Site, Selma, North Carolina," EPA Region IV. (July 2006) [Filed and cited in Entry Number 1 of 4.10 FEASIBILITY STUDY (FS) - Proposed Plans for Selected Remedial Action]

# PART 5: ATTACHED ARARS TABLES
## (ARARs that potentially apply to all alternatives in FS)

**Table**
**Summary of Potential Chemical-Specific ARARs**

| ARAR | Alternatives | Standard, Requirements Criteria, or Limitations | Description |
|---|---|---|---|
| 40 CFR 131 | Groundwater 1,2,3,4 | Water Quality Criteria | Sets criteria for water quality based on toxicity to aquatic organisms and human health |
| 40 CFR 141 | Groundwater 1,2,3,4 | National Primary Drinking Water Standards | Establishes health-based standards for public water systems |
| 40 CFR 142 | Groundwater 1,2,3,4 | Primary Maximum Contaminant Levels | Standards for the protection of human health |
| 130A NCAC 311-327 | Groundwater 1,2,3,4 | North Carolina Drinking Water Act | Regulates water systems within the state that supply drinking water that may affect the public health |
| 15A NCAC 2L | Groundwater 1,2,3,4 | North Carolina Drinking Water And Groundwater Standards | Establishes groundwater classifications and water quality standards |
| 15A NCAC 2B.0100 & 0.0200 | Groundwater 1,2,3,4 | North Carolina Water Quality Standards | Establishes groundwater classifications and water quality standards |
| 15A NCAC 2B.0400 | Groundwater 4 | North Carolina Surface Water Effluent Limitations | Establishes limits and guidelines for effluent discharged to waters of the site |
| 15A NCAC 2D, 2H, 2Q | Soil 2,3,4 | North Carolina Air Pollution Control Regulations | Regulates ambient air quality and establishes air quality standards |
| 15A NCAC 13A | Soil 2,3,4 | North Carolina Hazardous Waste Management Rules | Establishes standards for hazardous waste treatment facilities |

**Table**
**Summary of Potential Location-Specific ARARs**

| Location | Alternatives | ARAR | Standard, Requirements Criteria, or Limitations | Description |
|---|---|---|---|---|
| Wetlands | Soil 2,3,4 | 40 CFR 6.302 | Wetlands and Floodplains Executive Order | Action to minimize the destruction, loss, or degradation of wetlands |
| | Groundwater 4 | Clean Water Act Sections 301, 304, 306, 307, 308, 402, and 403 | Clean Water Act – Water Quality Standards | Standards that apply to discharge of wastewater into surface water bodies |
| | Soil 2,3,4 Groundwater 2,3,4 | 15A NCAC 2B 0.0200 and 0.0231 | North Carolina Surface Water and Wetland Standards | Water quality standards applicable to surface waters and wetlands in North Carolina |
| Landfill | Soil 2,3,4 | 15A NCAC 13A | North Carolina Hazardous Waste Management Rules | Location requirements for hazardous waste treatment/storage/disposal facilities |
| | Soil 4 | 15A NCAC 13B | North Carolina Solid Waste Management Rules | Siting requirements for solid waste disposal units |
| Site | Soil 2,3,4 Groundwater 2,3,4 | NC GS 130A-310.8 | Recordation of inactive hazardous waste sites | Deed notice to indicate prior hazardous waste activity at the site |

**Table**
**Summary of Potential Action-Specific ARARs**

| Activity | Alternatives | ARAR | Standard, Requirements Criteria, or Limitations | Description |
|---|---|---|---|---|
| Waste Characterization | Soil 2,3,4 | 40 CFR Part 61 or state equivalent | National Emission Standards for Hazardous Air Pollutants | Identifying and characterizing the waste as treated |
| Capping | Soil 2,3,4 | 40 CFR Part 264 | Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities | Standards that apply to surface impoundments |
| Soil Excavation | Soil 2,3,4 | Clean Air Act, 40 CFR 50.6, and 40 CFR 52 Subpart K | Clean Air Act – Air Quality Standards | Management of toxic pollutants and particulate matter in the air |
| | Soil 2,3,4 | 15A NCAC 2D, 2H, and 2Q | North Carolina Air Pollution Control Requirements | Standards apply to air pollution control air quality and emissions |
| | Soil 2,3,4 | 40 CFR Section 262 or state equivalent | Standards Applicable to Generators of Hazardous Waste | Standards that apply to the generation of hazardous waste |
| | Soil 2,3,4 | 15A NCAC 4 | North Carolina Sedimentation Control Rules | Requirements for prevention of sedimentation pollution |
| Storage Prior to Disposal | Soil 2,3,4 | 40 CFR Part 264 or state equivalent | Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities | Standards applicable to the storage of hazardous waste |
| Onsite/Offsite Disposal | Soil 4 | RCRA Subtitle D | Managing Municipal and Solid Waste | Standards that apply to the disposal of solid waste |
| | Soil 2,3,4 | 40 CFR Part 268 | Land Disposal Restrictions | Standards that restrict the placement of certain wastes in or on the ground |
| | Soil 2,3,4 | 15A NCAC 13B | North Carolina Solid Waste Management Rules | Solid Waste Management Rule |

(continuation)
**Table**
**Summary of Potential Action-Specific ARARs**

| Activity | Alternatives | ARAR | Standard, Requirements Criteria, or Limitations | Description |
|---|---|---|---|---|
| Transportation for Offsite Disposal | Soil 4 | 40 CFR Part 263 or state equivalent | Standards Applicable to the Transporters of Hazardous Waste | Manifest requirements and packaging and labeling requirements prior to transporting |
| | Soil 4 | 40 CFR Part 262 or state equivalent | Standards Applicable to the Generators of Hazardous Waste | Transportation Standards |
| | Soil 4 | 49 CFR Parts 172 and 173 | Hazardous Materials Special Provisions, Communications, Emergency Response Information, and Training Requirements; General Requirements for Shipments and Packaging | Standards that apply to the identification, labeling, packaging, and shipping of hazardous materials |
| Wastewater Discharge | Groundwater 4 | Clean Water Act Sections 301, 304, 306, 307, 308, 402, and 403 | Clean Water Act – Water Quality Standards including Ambient Water Quality Criteria | Standards that apply to discharge of wastewater into sewage treatment plant or surface water bodies |
| | Groundwater 4 | 40 CFR 122 | National Pollutant Discharge Elimination System | NPDES - Requires use of Best Available Treatment Technology |
| | Groundwater 4 | 15A NCAC 2L | North Carolina Groundwater Standards | Standards apply to surface water discharge |
| | Groundwater 4 | 15A NCAC 2B | North Carolina Water Quality Standards | Surface water quality standards |

# PART 6: ATTACHED RISK ASSESSMENT TABLES

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetic Average | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N,C) (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PBA | **TCL Pesticides** | | | | | | | | | | | | | |
| surface | 72-54-8 | 4,4'-DDD | 0.0014 | 6.5 (DJ) | mg/kg | PBM/SS-2 | 22/35 | 0.0038-0.051 | 0.36 | 6.5 (DJ) | 0.0098 | 10 (C) | N | BSL |
| soil | 72-55-9 | 4,4'-DDE | 0.0015 (J) | 0.23 | mg/kg | PBU/SS-3 | 30/35 | 0.0042-1.2 | 0.055 | 0.23 | 0.013 | 7 (C) | N | BSL |
| (0-0.5 ft bgs) | 50-29-3 | 4,4'-DDT | 0.0022 (JP) | 1.9 (D) | mg/kg | PBU/SS-3 | 30/35 | 0.0038-0.07 | 0.11 | 1.9 (D) | 0.012 | 7 (C) | N | BSL |
| | 309-00-2 | Aldrin | 0.0034 (J) | 0.0034 (J) | mg/kg | PO/SS-1 | 1/29 | 0.0017-0.063 | 0.00362 | 0.0034 (J) | 0.00225 | 0.1 (C) | N | BSL |
| | 5103-71-9 | alpha-Chlordane | 0.0023 (J) | 0.0057 (J) | mg/kg | PBU/SS-3 | 2/29 | 0.0017-0.063 | 0.00333 | 0.0057 (J) | 0.00225 | 6.5 (C) | N | BSL |
| | 60-57-1 | Dieldrin | 0.0005 (J) | 0.06 (J) | mg/kg | PO/SS-11 | 19/29 | 0.0038-0.078 | 0.00825 | 0.06 (J) | 0.0051 | 0.11 (C) | N | BSL |
| | 33213-65-9 | Endosulfan II | 0.009 (J) | 0.01 (J) | mg/kg | PBU/SS-3 | 2/29 | 0.0034-0.12 | 0.00672 | 0.01 (J) | 0.0044 | 370 (N) | N | BSL |
| | 72-20-8 | Endrin | 0.00054 (J) | 0.1 | mg/kg | PBU/SS-3 | 8/35 | 0.0023-0.12 | 0.0092 | 0.1 | 0.0044 | 18 (N) | N | BSL |
| | 53494-70-5 | Endrin ketone | 0.0019 (J) | 0.11 | mg/kg | PBU/SS-3 | 4/29 | 0.0034-0.12 | 0.00899 | 0.11 | 0.0044 | 18 (N) | N | BSL |
| | 58-89-9 | gamma-BHC (Lindane) | 0.00025 (J) | 0.0069 (J) | mg/kg | PBU/SS-3 | 4/29 | 0.0017-0.063 | 0.00333 | 0.0069 (J) | 0.00225 | 1.7 (C) | N | BSL |
| | 12789-03-6 | gamma-Chlordane | 0.0083 (J) | 0.0091 (J) | mg/kg | PBU/SS-3 | 2/29 | 0.0017-0.063 | 0.00342 | 0.0091 (J) | 0.00225 | 6.5 (C) | N | BSL |

Notes:
NA = Not applicable
(1) **Organic Data Qualifiers**
Concentration qualifiers:
D = Concentration is based on a diluted sample analysis.
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
P = Concentration difference between primary and confirmation columns was >25%.
(2) The maximum concentration was used for screening.
(3) Background values represent two-times the average background concentration.
(4) Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Industrial Soil.
(5) Codes used for rationale are as follows:
BSL = Below Screening Level

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**

**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetical Average | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APA | **TAL Metals** | | | | | | | | | | | | | |
| surface | 7440-38-2 | Arsenic | 1 (B) | 300 | mg/kg | GP-SB-19 (0-0.5') | 43/43 | NA | 18.1 | 300 | 15.2 | 1.6 (C) | Y | ASL |
| soil | 7439-92-1 | Lead | 13 | 36,000 | mg/kg | GP-SB-08 (0-0.5') | 43/43 | NA | 3120 | 36,000 | 281 | 400 | Y | ASL |
| (0-0.5 ft bgs) | 7487-94-7 | Mercury | 0.023 | 2.7 (B) | mg/kg | GP-SB-19 (0-0.5') | 43/43 | NA | 0.348 | 2.7 (B) | 0.15 | 31 (N) | N | BSL |

Notes:
NA = Not applicable

(1) **Inorganic Data Qualifiers**
Concentration qualifiers:
B = The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL)

(2) The maximum concentration was used for screening.

(3) Background values represent two-times the average background concentration.

(4) Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Industrial Soil. The lead value represents the USEPA Region 4-recommended screening value
C = Carcinogen
N = Noncarcinogen

(5) Codes used for rationale are as follows:
BSL = Below Screening Level
ASL = Above Screening Level

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**

**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Soil 0-2 feet
Exposure Medium: Soil 0-2 feet

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetic Average | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N,C) (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APA | TAL Metals | | | | | | | | | | | | | |
| surface and | 7440-38-2 | Arsenic | 0.6 (B) | 300 | mg/kg | GP-SB-19 (0-0.5') | 66/71 | 1-1.2 | 17.5 | 300 | 15.2 | 1.6 (C) | Y | ASL |
| shallow subsurface | 7439-92-1 | Lead | 6.8 (J) | 36,000 | mg/kg | GP-SB-08 (0-0.5') | 68/71 | 5.7-7.7 | 2280 | 36,000 | 281 | 400 | Y | ASL |
| soil | 7487-94-7 | Mercury | 0.0072 (BJ) | 2.7 (B) | mg/kg | GP-SB-19 (0-0.5') | 70/71 | 0.021-0.021 | 0.258 | 2.7 (B) | 0.15 | 31 (N) | N | BSL |
| (0-2 ft bgs) | | | | | | | | | | | | | | |

Notes:
NA = Not applicable

(1) **Inorganic Data Qualifiers**
Concentration qualifiers:
B = The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

(2) The maximum concentration was used for screening.

(3) Background values represent two-times the average background concentration.

(4) Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Industrial Soil. The lead value represents the USEPA Region 4-recommended screening value.
C = Carcinogen
N = Noncarcinogen

(5) Codes used for rationale are as follows:
BSL=Below Screening Level
ASL=Above Screening Level

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**

**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil
Exposure Medium: Surface and Subsurface Soil

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetic Average | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APA | **TAL Metals** | | | | | | | | | | | | | |
| surface & | 7440-38-2 | Arsenic | 0.6 (B) | 310 | mg/kg | GP-SB-16 (3-4') | 77/83 | 1-1.2 | 21.3 | 310 | 15.2 | 1.6 (C) | Y | ASL |
| subsurface | 7439-92-1 | Lead | 4.8 | 36,000 | mg/kg | GP-SB-08 (0-0.5') | 80/83 | 5.7-7.7 | 1920 | 36,000 | 281 | 400 | Y | ASL |
| soil | 7487-94-7 | Mercury | 0.0072 (BJ) | 2.7 (B) | mg/kg | GP-SB-19 (0-0.5') | 82/83 | 0.021-0.021 | 0.233 | 2.7 (B) | 0.15 | 31 (N) | N | BSL |
| (0-4 ft bgs) | | | | | | | | | | | | | | |

Notes:

NA = Not applicable

(1) **Inorganic Data Qualifiers**
Concentration qualifiers:
B = The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL)
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only

(2) The maximum concentration was used for screening.

(3) Background values represent two-times the average background concentration.

(4) Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Industrial Soil. The lead value is the USEPA Region 4-recommended screening value
C = Carcinogen
N = Noncarcinogen

(5) Codes used for rationale are as follows:
BSL = Below Screening Level
ASL = Above Screening Level

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PBA | **TCL Pesticides/PCBs** | | | | | | | | | | | | |
| Sediment | 72-54-8 | 4,4'-DDD | 0.29 (J) | 6.5 (DJ) | mg/kg | PBM/SS-2 | 7/7 | NA | 6.5 (DJ) | 0.0059 | 10 (C) | N | BSL |
| | 72-55-9 | 4,4'-DDE | 0.0031 (J) | 0.085 (J) | mg/kg | PBD/SS-1 | 5/7 | 0.0069-1.2 | 0.085 (J) | 0.0177 | 7 (C) | N | BSL |
| | 50-29-3 | 4,4'-DDT | 0.0065 (J) | 0.29 (DJ) | mg/kg | PBM/SS-2 | 7/7 | NA | 0.29 (DJ) | 0.0069 | 7 (C) | N | BSL |
| | **Miscellaneous** | | | | | | | | | | | | |
| | NA | Sulfate | 250 | 2100 | mg/kg | PBD/SS-1 | 6/7 | 280-280 | 2100 | 400 | NA | N | NSV |

Notes:
NA = Not applicable
(1) **Organic Data Qualifiers**
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
D =Concentration is based on a diluted sample analysis.
(2) The maximum concentration was used for screening.
(3) Background values represent two-times the average background concentration.
(4) Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Industrial Soil.
C = Carcinogen
(5) Codes used for rationale are as follows:
BSL = Below screening level
NSV = No screening value

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**

**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetic Average | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APA | **TAL Metals** | | | | | | | | | | | | | |
| Sediment | 7440-39-3 | Barium | 14 | 120 | mg/kg | AW/SD-4 | 2/2 | NA | 67 | 120 | 116 | 6700 (N) | N | BSL |
| | 7440-50-8 | Copper | 1.9 (B) | 93 | mg/kg | AW/SD-4 | 2/2 | NA | 47.5 | 93 | 31 | 4100 (N) | N | BSL |
| | 7439-92-1 | Lead | 16 | 180 | mg/kg | AW/SD-4 | 2/2 | NA | 98 | 180 | 178 | 400 | N | BSL |
| | 7487-94-7 | Mercury | 0.03 | 0.17 | mg/kg | AW/SD-4 | 2/2 | NA | 0.1 | 0.17 | 0.13 | 31 (N) | N | BSL |
| | 7440-66-6 | Zinc | 480 | 480 | mg/kg | AW/SD-4 | 1/2 | 3.8-3.8 | 241 | 480 | 430 | 100000 | N | BSL |

Notes:
NA = Not applicable
(1) **Inorganic Data Qualifiers**
B = The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
(2) The maximum concentration was used for screening.
(3) Background values represent two-times the average background concentration.
(4) Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Industrial Soil. The lead value represents the USEPA Region 4-recommended screening value.
(5) Codes used for rationale are as follows:
BSL = Below screening level

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**

**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PBA | **TAL Metals** | | | | | | | | | | | | |
| Surface | 7429-90-5 | Aluminum | 2,600 | 17,000 | ug/L | PBM/SW-1 | 4/4 | NA | 17,000 | 1,365 | -- | N | NSV |
| Water | 7440-38-2 | Arsenic | 20 | 20 | ug/L | PBD/SW-3 | 1/4 | 10-10 | 20 | 8.7 | 0.018 | Y | ASL |
| | 7440-70-2 | Calcium | 29,000 | 200,000 | ug/L | PBM/SW-1 | 4/4 | NA | 200,000 | 32,200 | -- | N | ENUT |
| | 7440-50-8 | Copper | 4.2 (B) | 38 | ug/L | PBD/SW-3 | 4/4 | NA | 38 | 16 | 1,300 | N | BSL |
| | 7439-89-6 | Iron | 1,900 (J) | 5,500 | ug/L | PBM/SW-1 | 4/4 | NA | 5,500 | 4,900 | 300 | Y | ASL |
| | 7786-30-3 | Magnesium | 2,900 | 6,000 | ug/L | PBM/SW-1 | 4/4 | NA | 6,000 | 5,050 | -- | N | ENUT |
| | 7439-96-5 | Manganese | 140 | 390 | ug/L | PBM/SW-1 | 4/4 | NA | 390 | 308.5 | 50 | Y | ASL |
| | 7440-02-0 | Nickel | 6.9 (B) | 24 (B) | ug/L | PBM/SW-1 | 4/4 | NA | 24 (B) | 22 | 610 | N | BSL |
| | 9/7/7440 | Potassium | 4500 | 15,000 | ug/L | PBM/SW-1 | 4/4 | NA | 15,000 | 7,050 | -- | N | ENUT |
| | 7440-66-6 | Zinc | 42 (J) | 260 | ug/L | PBD/SW-3 | 3/4 | 47-47 | 260 | 219 | 7,400 | N | BSL |
| | **Miscellaneous** | | | | | | | | | | | | |
| | NA | Sulfate | 51 | 470 (J) | ug/L | PBM/SW-1 | 4/4 | NA | 470 (J) | 34.1 | -- | N | NSV |

Notes:
NA = Not applicable

(1) **Inorganic Data Qualifiers**
Concentration qualifiers:
B = The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

(2) The maximum concentration was used for screening.

(3) Background values represent two-times the average background concentration.

(4) Screening toxicity values are the USEPA (2002) National Recommended Water Quality Criteria for Human Health: Consumption of Water and Organism.

(5) Codes used for rationale are as follows:
ASL = Above screening level
BSL = Below screening level
ENUT = Essential nutrient
NSV = No screening value

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**

**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetic Average | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APA | **TAL Metals** | | | | | | | | | | | | | |
| Surface | 7429-90-5 | Aluminum | 1,900 (J) | 10,000 | ug/L | AW/SW-1 | 2/2 | NA | 5950 | 10,000 | 1365 | -- | N | NSV |
| Water | 7440-50-8 | Copper | 13 (B) | 47 | ug/L | AW/SW-1 | 2/2 | NA | 29.3 | 47 | 16 | 1,300 | N | BSL |
| | 7440-23-5 | Sodium | 12,000 | 55,000 | ug/L | AW/SW-4 | 2/2 | NA | 33800 | 55,000 | 26000 | -- | N | ENUT |
| | 7440-66-6 | Zinc | 57 | 430 | ug/L | AW/SW-1 | 2/2 | NA | 241 | 430 | 219 | 7,400 | N | BSL |
| | **Miscellaneous** | | | | | | | | | | | | | |
| | NA | Sulfate | 39 | 170 | ug/L | AW/SW-1 | 2/2 | NA | 89.5 | 170 | 34.1 | -- | N | NSV |

Notes:
NA = Not applicable

(1) **Inorganic Data Qualifiers**
Concentration qualifiers:
B = The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

(2) The maximum concentration was used for screening.

(3) Background values represent two-times the average background concentration.

(4) Screening toxicity values are the USEPA (2002) National Recommended Water Quality Criteria for Human Health: Consumption of Water and Organism.

(5) Codes used for rationale are as follows:
BSL = Below screening level
ENUT = Essential nutrient
NSV = No screening value

TABLE

GURLEY PESTICIDE BURIAL SITE

SELMA, NORTH CAROLINA

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetic Average (2) | Concentration Used for Screening (3) | Background Value (4) | Screening Toxicity Value (N/C) (5) | COPC Flag (Y/N) | Rationale for Selection or Deletion (6) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PBA Groundwater | **TCL VOCs** | | | | | | | | | | | | | |
| | 79-34-5 | 1,1,2,2-Tetrachloroethane | 0.33 (J) | 0.33 (J) | ug/L | PMW-6S | 1/9 | 1-1 | 0.481 | 0.33 (J) | -- | 0.055 (C) | Y | ASL |
| | 71-43-2 | Benzene | 8 (J) | 8 (J) | ug/L | PMW-4S | 1/9 | 1-1 | 1.33 | 8 (J) | -- | 0.35 (C) | Y | ASL |
| | 1330-20-7 | Xylenes, Total | 0.64 (J) | 24 | ug/L | PMW-2S | 3/9 | 2-2 | 3.54 | 24 | -- | 21 (N) | Y | ASL |
| | **TCL Pesticides** | | | | | | | | | | | | | |
| | 72-54-8 | 4,4'-DDD | 0.33 | 0.33 | ug/L | PMW-4S | 1/9 | 0.1-0.1 | 0.0811 | 0.33 | -- | 0.28 (C) | Y | ASL |
| | 50-29-3 | 4,4'-DDT | 0.53 (JN) | 0.53 (JN) | ug/L | PMW-4S | 1/9 | 0.1-0.1 | 0.103 | 0.53 (JN) | -- | 0.2 (C) | Y | ASL |
| | 319-84-6 | alpha-BHC | 0.069 (JN) | 0.069 (JN) | ug/L | PMW-4S | 1/9 | 0.05-0.05 | 0.0299 | 0.069 (JN) | -- | 0.011 (C) | Y | ASL |
| | 58-89-9 | gamma-BHC (Lindane) | 0.01 (JN) | 0.19 | ug/L | PMW-3S | 3/9 | 0.05-0.05 | 0.0401 | 0.19 | -- | 0.052 (C) | Y | ASL |
| | 1024-57-3 | Heptachlor epoxide | 0.75 (JN) | 0.75 (JN) | ug/L | PMW-4S | 1/9 | 0.05-0.05 | 0.106 | 0.75 (JN) | -- | 0.0074 (C) | Y | ASL |
| | **TAL Metals** | | | | | | | | | | | | | |
| | 7440-38-2 | Arsenic | 22 | 22 | ug/L | PMW-3S | 1/1 | NA | 22 | 22 | -- | 0.045 (C) | Y | ASL |

Notes:
NA = Not applicable

[1] **Organic Data Qualifiers**
Concentration qualifiers:
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
JN= The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identificaiton. Value is estimated concentration.

[2] Arithmetic averages for PBA groundwater are higher than maximum detected concentrations because 1/2 the laboratory detection limits were included in the calculation of the arithmetic average.

[3] The maximum concentration was used for screening.

[4] Background values were not used for screening. (No site-specific background groundwater data were collected.)

[5] Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Tap Water.

[6] Codes used for rationale are as follows:
ASL = Above screening level

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**

**SELMA, NORTH CAROLINA**

**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN**

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum Concentration (Qualifier) (1) | Maximum Concentration (Qualifier) (1) | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Arithmetic Average | Concentration Used for Screening (2) | Background Value (3) | Screening Toxicity Value (N/C) (4) | COPC Flag (Y/N) | Rationale for Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APA | **TCL VOCs** | | | | | | | | | | | | | |
| Ground | 78-87-5 | 1,2-Dichloropropane | 0.53 (J) | 7.4 | ug/L | AMW-6S | 2/11 | 1-2 | 1.18 | 7.4 | -- | 0.16 (C) | Y | ASL |
| water | 71-43-2 | Benzene | 1 | 65 | ug/L | AMW-1S | 2/11 | 1-1 | 6.41 | 65 | -- | 0.35 (C) | Y | ASL |
| | **TAL Metals** | | | | | | | | | | | | | |
| | 7440-38-2 | Arsenic | 11 | 120 | ug/L | AMW-1S | 7/12 | 10-10 | 35.2 | 120 | -- | 0.045 (C) | Y | ASL |

Notes:
NA = Not applicable
[1] **Organic Data Qualifiers**
Concentration qualifiers:
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
[2] The maximum concentration was used for screening.
[3] Background values were not used for screening. (No site-specific background groundwater data were collected.)
[4] Screening toxicity values are the USEPA Region 9 Preliminary Remediation Goals for Tap Water.
[5] Codes used for rationale are as follows:
ASL = Above screening level

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**HUMAN HEALTH EXPOSURE POINT CONCENTRATIONS**

| Area of Concern | Medium | Receptor(s) | Constituent | EPC | Units | EPC Rationale (1) |
|---|---|---|---|---|---|---|
| Acid Plant Area | Surface Soil (0-0.5 ft bgs) | Trespasser | Arsenic | 24.6 | mg/kg | 95% H-UCL (lognormal distribution) |
| | Surface and Shallow Subsurface Soil (0-2 ft bgs) | Industrial worker | Arsenic | 24.1 | mg/kg | 95% H-UCL (lognormal distribution) |
| | Surface and Subsurface Soil (0-4 ft bgs) | Construction worker | Arsenic | 28.8 | mg/kg | 95% H-UCL (lognormal distribution) |
| | Groundwater | Construction worker | 1,2-Dichloropropane | 0.0039 | mg/L | 95% Chebyshev UCL (non-parametric distribution) |
| | | | Benzene | 0.065 | mg/L | 99% Chebyshev UCL (non-parametric distribution) |
| | | | Arsenic | 0.069 | mg/L | 95% Approximate Gamma UCL (gamma distribution) |
| Pesticide Burial Area | Surface Water | Trespasser, industrial worker, construction worker | Arsenic | 0.02 | mg/L | Maximum concentration |
| | | | Manganese | 0.39 | mg/L | Maximum concentration |
| | Groundwater | Construction worker | 1,1,2,2-Tetrachloroethane | 0.00033 | mg/L | Maximum concentration |
| | | | Benzene | 0.008 | mg/L | Maximum concentration |
| | | | Xylenes, total | 0.024 | mg/L | Maximum concentration |
| | | | 4,4'-DDD | 0.00033 | mg/L | Maximum concentration |
| | | | 4,4'-DDT | 0.00053 | mg/L | Maximum concentration |
| | | | alpha-BHC | 0.000069 | mg/L | Maximum concentration |
| | | | gamma-BHC (lindane) | 0.00019 | mg/L | Maximum concentration |
| | | | Heptachlor epoxide | 0.00075 | mg/L | Maximum concentration |
| | | | Arsenic | 0.022 | mg/L | Maximum concentration |

Notes:

(1) The USEPA (2004) ProUCL software was used to calculate the EPCs. EPCs represent the UCL recommended by the ProUCL software, which is based on distribution of the dataset. Per USEPA (1992) Supplemental Guidance to RAGS: Calculating the Concentration Term, the maximum concentration is used as the EPC when the dataset contains less than 10 samples.

EPC = Exposure point concentration

mg/kg = milligrams per kilogram

ug/L = micrograms per liter

bgs = below ground surface

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**EXPOSURE FACTORS FOR SOIL**

| Exposure Factors | Units | Trespasser | Industrial Worker | Construction Worker |
|---|---|---|---|---|
| Cancer Slope Factor (CSFo) | $(mg/kg\text{-}day)^{-1}$ | chemical-specific | chemical-specific | chemical-specific |
| Reference Dose (RfDo) | mg/kg-day | chemical-specific | chemical-specific | chemical-specific |
| Cancer Slope Factor (CSFd) | $(mg/kg\text{-}day)^{-1}$ | chemical-specific | chemical-specific | chemical-specific |
| Reference Dose (RfDd) | mg/kg-day | chemical-specific | chemical-specific | chemical-specific |
| Cancer Slope Factor (CSFI) | $(mg/kg\text{-}day)^{-1}$ | chemical-specific | chemical-specific | chemical-specific |
| Reference Dose (RfDI) | mg/kg-day | chemical-specific | chemical-specific | chemical-specific |
| Exposure Point Concentration (EPC) | mg/kg | chemical-specific | chemical-specific | chemical-specific |
| Body Weight (BW) | kg | 45 | 70 | 70 |
| Soil Ingestion Rate (IR) | mg/day | 100 | 100 | 330 |
| Exposed Surface Area (SA) | $cm^2$/day | 4300 | 3300 | 3300 |
| Adherence Factor (AF) | $mg/cm^2$ | 0.2 | 0.2 | 0.3 |
| Absorption Fraction (ABS) | percent | chemical-specific | chemical-specific | chemical-specific |
| Inhalation Rate (IRA) | $m^3$/day | 20 | 20 | 20 |
| Particulate Emission Factor (PEF) | $m^3$/kg | 1.32E+09 | 1.32E+09 | 1.32E+09 |
| Volatilization Factor (VF) | $m^3$/kg | chemical-specific | chemical-specific | chemical-specific |
| Exposure Frequency (EF) | days/year | 52 | 225 | 30 |
| Exposure Duration (ED) | years | 10 | 25 | 1 |
| Fraction Ingested from Site (FI) | unitless | 1 | 1 | 1 |
| Averaging Time (Cancer) (ATc) | days | 25550 | 25550 | 25550 |
| Averaging Time (Non-Cancer) (ATnc) | days | 3650 | 9125 | 365 |

Equations:

Trespasser, Industrial Worker, and Construction Worker Exposure Scenarios

Carcinogens = [((CSFo * EPC * CF * EF * ED * IR * FI)/ (ATc * BW)) + ((CSFd * EPC * EF * ED * SA * AF* ABS * CF)/(ATc * BW)) + ((CFSI * EPC * IR * EF* ED* 1/VFor 1/PEF)/ (ATc * BW))]

Non-carcinogens = [((1/RfDo * EPC * EF * ED * IR * FI * CF)/ (ATnc * BW)) + ((1/RfDd * EPC * EF * ED * SA * ABS * AF * CF)/(ATnc * BW)) + ((1/RfDi * EPC * IR * EF* ED * 1/VFor 1/PEF)/(ATnc * BW))]

Notes:

Chemical-specific data are provided in Table 25. Chemical-specific toxicity data are provided in Tables 26 and 27.

Site-specific exposure frequencies and durations are described in the human health risk assessment text.

VF is used for volatile chemicals.

Default PEF is used for non-volatiles.

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**EXPOSURE FACTORS FOR SURFACE WATER**

| Exposure Factors | Units | Trespasser | Industrial Worker | Construction Worker |
|---|---|---|---|---|
| Cancer Slope Factor (CSFo) | $(mg/kg\text{-}day)^{-1}$ | chemical-specific | chemical-specific | chemical-specific |
| Reference Dose (RfDo) | mg/kg-day | chemical-specific | chemical-specific | chemical-specific |
| Cancer Slope Factor (CSFd) | $(mg/kg\text{-}day)^{-1}$ | chemical-specific | chemical-specific | chemical-specific |
| Reference Dose (RfDd) | mg/kg-day | chemical-specific | chemical-specific | chemical-specific |
| Exposure Point Concentration (EPC) | mg/L; $mg/cm^3$ | chemical-specific | chemical-specific | chemical-specific |
| Conversion Factor (CF) | $liter/cm^3$ | 0.001 | 0.001 | 0.001 |
| Ingestion Rate (IR) | liters/hour | 0.01 | 0.01 | 0.01 |
| Body Weight (BW) | kg | 45 | 70 | 70 |
| Exposed Surface Area (SA) | $cm^2$ | 4300 | 3300 | 3300 |
| Permeability Constant (Kp) | cm/hour | chemical-specific | chemical-specific | chemical-specific |
| Fraction Absorbed (FA) | unitless | chemical-specific | chemical-specific | chemical-specific |
| Ratio of permeability coefficients (B) | unitless | chemical-specific | chemical-specific | chemical-specific |
| Event Duration ($t_{event}$) | hour/event | 1 | 1 | 1 |
| Lag Timer per Event (T-event) | hour/event | chemical-specific | chemical-specific | chemical-specific |
| Event Frequency (EV) | events/day | 1 | 1 | 1 |
| Exposure Frequeny (EF) | days/year | 52 | 225 | 30 |
| Exposure Duration (ED) | years | 10 | 25 | 1 |
| Exposure Time (ET) | hour/day | 1 | 1 | 1 |
| Averaging Time (Cancer) (ATc) | days | 25550 | 25550 | 25550 |
| Averaging Time (Non-Cancer) (ATnc) | days | 3650 | 9125 | 365 |

Equations:

Trespasser, Industrial Worker, and Construction Worker Exposure Scenarios

Inorganics:

Carcinogens = $[((EPC * IR * EF * ED * ET * CSFo)/(ATc * BW)) + ((DAevent * EV * ED * EF * SA * CSFd)/(ATc * BW))]$

Non-carcinogens = $[((EPC * IR * EF * ED * ET * 1/RfDo)/(ATnc * BW)) + ((DAevent * EV * ED * EF *SA * 1/RfDd)/(ATnc * BW))]$

where: $DA_{event} = Kp * EPC * t\text{-}event$

Organics:

Carcinogens = $[((EPC * IR * EF * ED * ET * CSFo)/(ATc * BW)) + ((DAevent * EV * ED * EF * SA * CSFd)/(ATc * BW))]$

Non-carcinogens = $[((EPC * IR * EF * ED * ET * 1/RfDo)/(ATnc * BW)) + ((DAevent * EV * ED * EF *SA * 1/RfDd)/(ATnc * BW))]$

where: if $t_{event} \leq t^*$, then $DA_{event} = (2FA * Kp * EPC * ((\sqrt{(6T\text{-}event * t\text{-}event)}/\pi))$

where: if $t_{event} > t^*$, then $DA_{event} = (FA * Kp * EPC *((((t\text{-}event/(1 + B) + 2T\text{-}event * ((1 + 3B + 3B^2)/(1 + B)^2)))$

Notes:

Chemical-specific data are provided in Table 25. Chemical-specific toxicity data are provided in Tables 26 and 27.

Site-specific exposure frequencies and durations are described in the human health risk assessment text.

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**EXPOSURE FACTORS FOR GROUNDWATER**

| Exposure Factors | Units | Construction Worker |
|---|---|---|
| Cancer Slope Factor (CSFo) | $(mg/kg\text{-}day)^{-1}$ | chemical-specific |
| Reference Dose (RfDo) | mg/kg-day | chemical-specific |
| Cancer Slope Factor (CSFd) | $(mg/kg\text{-}day)^{-1}$ | chemical-specific |
| Reference Dose (RfDd) | mg/kg-day | chemical-specific |
| Exposure Point Concentration (EPC) | $mg/L; mg/cm^3$ | chemical-specific |
| Conversion Factor (CF) | $liter/cm^3$ | 0.001 |
| Ingestion Rate (IR) | liters/hour | 0.05 |
| Body Weight (BW) | kg | 70 |
| Exposed Surface Area (SA) | $cm^2$ | 3300 |
| Permeability Constant (Kp) | cm/hour | chemical-specific |
| Fraction Absorbed (FA) | unitless | chemical-specific |
| Ratio of permeability coefficients (B) | unitless | chemical-specific |
| Event Duration ($t_{event}$) | hour/event | 2 |
| Lag Timer per Event (T-event) | hour/event | chemical-specific |
| Event Frequency (EV) | events/day | 1 |
| Exposure Frequeny (EF) | days/year | 30 |
| Exposure Duration (ED) | years | 1 |
| Exposure Time (ET) | hour/day | 2 |
| Averaging Time (Cancer) (ATc) | days | 25550 |
| Averaging Time (Non-Cancer) (ATnc) | days | 365 |

Equations:

Trespasser, Industrial Worker, and Construction Worker Exposure Scenarios

Inorganics:

Carcinogens = $[((EPC * IR * EF * ED * ET * CSFo)/(ATc * BW)) + ((DAevent * EV * ED * EF * SA * CSFd)/(ATc * BW))]$

Non-carcinogens = $[((EPC * IR * EF * ED * ET * 1/RfDo)/(ATnc * BW)) + ((DAevent * EV * ED * EF * SA * 1/RfDd)/(ATnc * BW))]$

where: $DA_{event} = Kp * EPC * t\text{-}event$

Organics:

Carcinogens = $[((EPC * IR * EF * ED * ET * CSFo)/(ATc * BW)) + ((DAevent * EV * ED * EF * SA * CSFd)/(ATc * BW))]$

Non-carcinogens = $[((EPC * IR * EF * ED * ET * 1/RfDo)/(ATnc * BW)) + ((DAevent * EV * ED * EF * SA * 1/RfDd)/(ATnc * BW))]$

where: if $t_{event} \leq t^*$, then $DA_{event} = (2FA * Kp * EPC * ((\sqrt{(6T\text{-}event * t\text{-}event)}/\pi))$

where: if $t_{event} > t^*$, then $DA_{event} = (FA * Kp * EPC * (((t\text{-}event/(1 + B) + 2T\text{-}event * ((1 + 3B + 3B^2)/(1 + B)^2)))$

Notes:

Chemical-specific data are provided in Table 25. Chemical-specific toxicity data are provided in Tables 26 and 27.

Site-specific exposure frequencies and durations are described in the human health risk assessment text.

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**CHEMICAL SPECIFIC DATA FOR DERMAL RISK ASSESSMENT**

| Constituent | ABS (dimensionless) | FA (dimensionless) | Kp (cm/hour) | B (dimensionless) | T-event (hour) |
|---|---|---|---|---|---|
| Arsenic | 0.03 | -- | 1.00E-03 | -- | -- |
| Manganese | 0.001 | -- | 1.00E-03 | -- | -- |
| Benzene | 0.01 | 1 | 1.5E-02 | 0.10 | 0.29 |
| 1,1,2,2-Tetrachloroethane | 0.01 | 1 | 6.9E-03 | 0.00 | 0.93 |
| Xylenes | 0.01 | 1 | 5.3E-02 | 0.20 | 0.42 |
| 1,2-Dichloropropane | 0.01 | 1 | 7.8E-03 | 0.00 | 0.46 |
| DDD | 0.01 | 1 | 1.8E-01 | 1.20 | 6.65 |
| DDT | 0.03 | 1 | 2.7E-01 | 1.90 | 10.45 |
| Heptachlor epoxide | 0.01 | 1 | 8.6E-03 | 0.10 | 13.27 |
| alpha-BHC | 0.01 | -- | -- | -- | -- |
| gamma-BHC | 0.04 | -- | -- | -- | -- |

Notes:
Values were taken from USEPA (2004) Risk Assessment Guidance for Superfund, Part E: Dermal Risk Assessment.

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**CANCER TOXICITY DATA**

| Chemical of Potential Concern | Oral Cancer Slope Factor | | Oral Absorption Efficiency for Dermal (1) | Adjusted Dermal (Absorbed) Cancer Slope Factor | | Inhalation Cancer Slope Factor | | Cancer Type | Tumor Site (Target Organ) | Weight of Evidence/ Cancer Guideline Description | CSF | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Value | Units | | Value | Units | Value | Units | | | | Source(s) | Date(s) (MM/DD/YYYY) |
| Arsenic | 1.5E+00 | (mg/kg-day)$^{-1}$ | 0.95 | 1.5E+00 | (mg/kg-day)$^{-1}$ | 1.5E+01 | (mg/kg-day)$^{-1}$ | lung, skin, kidney, bladder, liver | Human | A | IRIS | 04/21/05 |
| Manganese | NA | NA | 0.04 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | 5.5E-02 | (mg/kg-day)$^{-1}$ | >0.50 | 5.5E-02 | (mg/kg-day)$^{-1}$ | 2.7E-02 | (mg/kg-day)$^{-1}$ | Leukemia | Human | A | IRIS | 04/21/05 |
| 1,1,2,2-Tetrachloroethane | 2.0E-01 | (mg/kg-day)$^{-1}$ | >0.50 | 2.0E-01 | (mg/kg-day)$^{-1}$ | 2.0E-01 | (mg/kg-day)$^{-1}$ | Liver | Mice | C | IRIS | 04/21/05 |
| Xylenes | NA | NA | >0.50 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | 6.8E-02 | (mg/kg-day)$^{-1}$ | >0.50 | 6.8E-02 | (mg/kg-day)$^{-1}$ | NA | NA | Liver | Mice | NI | IRIS | 04/21/05 |
| DDD | 2.4E-01 | (mg/kg-day)$^{-1}$ | NA | 2.4E-01 | (mg/kg-day)$^{-1}$ | NA | NA | Lung, liver, thyroid | Mice | B2 | IRIS | 04/21/05 |
| DDT | 3.4E-01 | (mg/kg-day)$^{-1}$ | 0.70 - 0.90 | 3.4E-01 | (mg/kg-day)$^{-1}$ | 3.4E-01 | (mg/kg-day)$^{-1}$ | Liver | Mice, rats | B2 | IRIS | 04/21/05 |
| Heptachlor epoxide | 9.1E+00 | (mg/kg-day)$^{-1}$ | >0.50 | 9.1E+00 | (mg/kg-day)$^{-1}$ | 9.1E+00 | (mg/kg-day)$^{-1}$ | Liver | Mice, rats | B2 | IRIS | 04/21/05 |
| alpha-BHC | 6.3E+00 | (mg/kg-day)$^{-1}$ | >0.50 | 6.3E+00 | (mg/kg-day)$^{-1}$ | 6.3E+00 | (mg/kg-day)$^{-1}$ | Liver | Mice, rats | B2 | IRIS | 04/21/05 |
| gamma-BHC (Lindane) | 1.3E+00 | (mg/kg-day)$^{-1}$ | >0.50 | 1.3E+00 | (mg/kg-day)$^{-1}$ | NA | NA | Liver | Mice | NI | IRIS | 04/21/05 |

Notes:
(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Section 4.2 and Exhibit 4-1. As indicated in RAGS Part E, only chemicals with an oral absorption factor <50% were adjusted to account for absorbed dose in the dermal exposure pathway.
NA = Not available
NI = No information

Definitions:
IRIS = Integrated Risk Information System
A - Human Carcinogen - sufficient evidence in humans.
B2 - Probable Human Carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible Human Carcinogen

**TABLE**

**GURLEY PESTICIDE BURIAL SITE**
**SELMA, NORTH CAROLINA**

**NON-CANCER TOXICITY DATA**

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD | | Oral Absorption Efficiency for Dermal | Adjusted RfD for Dermal | | Inhalation RfC | | Critical Effect | Uncertainty Factors | Modifying Factor | Confidence Level | RfD/RfC Source(s) | RfD/RfC Date (MM/DD/YYYY) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Value | Units | | Value | Units | Value | Units | | | | | | |
| Arsenic | Chronic | 3.0E-04 | mg/kg/day | 0.95 | 3.0E-04 | mg/kg/day | NA | NA | hyperpigmentation, keratosis, vascular complications | 3 | 1 | Medium | IRIS | 4/21/2005 |
| Manganese | Chronic | 4.6E-02 | mg/kg/day | 0.04 | 1.8E-03 | mg/kg/day | 1.4E-05 | mg/kg/day | Central nervous system | 1 | 1 | Medium | IRIS | 4/21/2005 |
| Benzene | Chronic | 4.0E-03 | mg/kg/day | >0.50 | 4.0E-03 | mg/kg/day | 8.6E-03 | mg/kg/day | Decreased lymphocyte count | 300 | 1 | Medium | IRIS | 4/21/2005 |
| 1,1,2,2-Tetrachloroethane | Chronic | 6.0E-02 | mg/kg/day | >0.50 | 6.0E-02 | mg/kg/day | NA | NA | NI | NI | NI | NI | PPRTV | 4/21/2005 |
| Xylenes | Chronic | 2E-01 | mg/kg/day | >0.50 | 2E-01 | mg/kg/day | 2.9E-02 | mg/kg/day | Decreased body weight, increased mortality | 1000 | 1 | Medium | IRIS | 4/21/2005 |
| 1,2-Dichloropropane | Chronic | 1.1E-03 | mg/kg/day | >0.50 | 1.1E-03 | mg/kg/day | 1.1E-03 | mg/kg/day | Hyperplasia of the nasal mucosa | 300 | 1 | Medium | IRIS | 4/21/2005 |
| DDD | Chronic | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| DDT | Chronic | 5.0E-04 | mg/kg/day | 0.70 - 0.90 | 5.0E-04 | mg/kg/day | NA | NA | Liver lesions | 100 | 1 | Medium | IRIS | 4/21/2005 |
| Heptachlor epoxide | Chronic | 1.3E-05 | mg/kg/day | >0.50 | 1.3E-05 | mg/kg/day | NA | NA | Increased liver-to-body weight ratio | 1000 | 1 | Low | IRIS | 4/21/2005 |
| alpha-BHC | Chronic | 5.0E-04 | mg/kg/day | >0.50 | 5.0E-04 | mg/kg/day | NA | NA | NI | NI | NI | NI | NCEA | 4/21/2005 |
| gamma-BHC (Lindane) | Chronic | 3.0E-04 | mg/kg/day | >0.50 | 3.0E-04 | mg/kg/day | NA | NA | Liver and kidney toxicity | 1000 | 1 | Medium | IRIS | 4/21/2005 |

Notes:
(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Section 4.2 and Exhibit 4-1. As indicated in RAGS Part E, only chemicals with an oral absorption factor <50% were adjusted to account for absorbed dose in the dermal exposure pathway.

NA = Not Available

NI = No Information

Definitions:

IRIS = Integrated Risk Information System

NCEA = National Center for Environmental Assessment

PPRTV = Provisional Peer-Reviewed Toxicity Value

Table

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

**Ecological Exposure Assumptions**

| Species / Exposure Variable | | Value | Source |
|---|---|---|---|
| **Short-tailed Shrew** | | | |
| BW | Body weight (kg) | 0.017 | Average body weight for M/F shrews; estimated from USEPA (1993). |
| $FR_{diet}$ | Percent of Diet from Site | 100% | Each area represents 100% of the foraging range. |
| | Dietary Composition | 100% Inv | Dietary composition from USEPA (1993). |
| NFMR | Metabolic Rate (kcal/g-day) | 0.64 | Average daily metabolic rate, from USEPA (1993). |
| GE | Gross Energy (kcal/g) | 1.7 | Grasshoppers, crickets, from USEPA (1993). |
| AE | Assimilation Efficiency | 87% | Mammals eating insects, from USEPA (1993). |
| $FR_{soil}$ | Percent Soil in Diet | 2.4% | Intake for meadow vole, from USEPA (1993). |
| IR | Food Ingestion Rate (kg/day dry wt.) | 0.0015 | Mean food ingestion (USEPA, 1993), multiplied by body weight and solid content [(0.58 g/g-day) x (17 g) X (0.16 solids) = 1.5 g/day). |
| **Raccoon** | | | |
| BW | Body weight (kg) | 5.78 | Average body weight for M/F raccoon; estimated from USEPA (1993). |
| $FR_{diet}$ | Percent of Diet from Site | 25% | Each area represents 25% of the foraging range based on average home range size from USEPA (1993). |
| | Dietary Composition | 40% Veg, 30% Inv, 15% Frog, 15% SM | Average annualized diet estimated from USEPA (1993). |
| NFMR | Metabolic Rate (kcal/g-day) | 0.19 | Free-living metabolic rate for raccoons, from USEPA (1993). |
| | Gross Energy (kcal/g) | 1.1 (Veg), 1.7 (Inv), 1.2 (Frog), 1.7 (SM) | From Table 4-1 in USEPA (1993). |
| GE | Weighted Gross Energy kcal/g) | 1.4 | Calculated based on gross energy for individual food items. |
| | Assimilation Efficiency (%) | 76% (Veg), 87% (Inv), 91% (Frog), 84% (SM) | From Table 4-3 in USEPA (1993). |
| AE | Weighted Assimilation Efficiency (%) | 83% | Calculated based on assimilation efficiency for individual food items. |
| $FR_{soil}$ | Percent Soil/Sediment in Diet | 9.4% | Intake for raccoon, from USEPA (1993). |
| IR | Food Ingestion Rate (kg/day dry wt.) | 0.29 | Calculated using equation 3-7 of USEPA (1993). |
| **Long-tailed Weasel** | | | |
| BW | Body weight (kg) | 0.205 | Average of males and females from Burt and Grossenheider (1976). |
| $FR_{diet}$ | Percent of Diet from Site | 50% | Each area represents 50% of the foraging range. |
| | Dietary Composition | 100% SM | From Burt and Grossenheider (1976). |
| NFMR | Metabolic Rate (kcal/g-day) | 0.296 | Calculated using equation 3-47 for non-herbivores from USEPA (1993). |
| GE | Gross Energy (kcal/g) | 1.7 | From Table 4-1 in USEPA (1993). |
| AE | Assimilation Efficiency | 84% | From Table 4-3 in USEPA (1993). |
| $FR_{soil}$ | Percent Soil in Diet | 2.8% | Intake for other terrestrial predator (red fox) from USEPA (1993). |
| IR | Food Ingestion Rate (kg/day dry wt.) | 0.019 | Calculated using equation 3-7 from USEPA (1993). |

**Table**

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

**Ecological Exposure Assumptions**

| Species / Exposure Variable | | Value | Source |
|---|---|---|---|
| **American Robin** | | | |
| BW | Body weight (kg) | 0.08 | Average body weight for M/F robins, from USEPA (1993). |
| $FR_{diet}$ | Percent of Diet from Site | 25% | Each area represents 25% of the foraging range. |
| | Dietary Composition | 25% Inv, 75% Fruit | Diet of birds from the eastern U.S. in summer, fall, and winter months is dominated by fruits (USEPA, 1993). |
| NFMR | Metabolic Rate (kcal/g-day) | 0.71 | Free-living metabolic rate for robins, from USEPA (1993). |
| | Gross Energy (kcal/g) | 1.7 (Inv), 1.1 (Fruit) | Grasshoppers, crickets, from USEPA (1993). |
| GE | Weighted Gross Energy kcal/g) | 1.3 | Calculated based on gross energy for individual food items. |
| | Assimilation Efficiency (%) | 72% (Inv), 64% (Fruit) | Birds eating terrestrial insects, birds eating fruit pulp and skin from USEPA (1993). |
| AE | Weighted Assimilation Efficiency (%) | 66% | Calculated based on assimilation efficiency for individual food items. |
| $FR_{soil}$ | Percent Soil/Sediment in Diet | 3% | Estimated based on data for various birds from USEPA (1993) and dietary composition (25% invertebrates, 75% fruits). |
| IR | Food Ingestion Rate (kg/day dry wt.) | 0.015 | Mean food ingestion rate (USEPA, 1993) multiplied by body weight and solid content [(1.2 g/g-day) x (80 g) x (0.16 solids) = 0.015 g/day] |
| **Green Heron** | | | |
| BW | Body weight (kg) | 0.2 | Average of males and females from Buonanno (1995). |
| $FR_{diet}$ | Percent of Diet from Site | 25% | Each area represents 25% of the foraging range based on regional value of onsite habitats. |
| | Dietary Composition | 100% Frog | From Buonanno (1995). |
| NFMR | Metabolic Rate (kcal/g-day) | 0.39 | From equation 3-34 in USEPA (1993) |
| GE | Gross Energy (kcal/g) | 1.2 | From Table 4-1 in USEPA (1993) |
| AE | Assimilation Efficiency | 78% | From Table 4-3 in USEPA (1993) |
| $FR_{soil}$ | Percent Sediment in Diet | 18% | mean value for shorebirds from USEPA (1993) |
| IR | Food Ingestion Rate (kg/day dry wt.) | 0.020 | Calculated using equation 3-3 of USEPA (1993) |
| **Common Screech Owl** | | | |
| BW | Body weight (kg) | 0.2 | Average of males and females from WSPA (2004). |
| $FR_{diet}$ | Percent of Diet from Site | 25% | Each area represents 25% of the foraging range based on regional value of onsite habitats. |
| | Dietary Composition | 50% Inv, 50% SM | From USGS (2004). |
| NFMR | Metabolic Rate (kcal/g-day) | 0.38 | From equation 3-34 in USEPA (1993) |
| | Gross Energy (kcal/g) | 1.7 (Inv), 1.7 (SM) | From Table 4-1 in USEPA (1993) |
| GE | Weighted Gross Energy kcal/g) | 1.7 | Calculated based on gross energy for individual food items. |
| | Assimilation Efficiency (%) | 72% (Inv), 78% (SM) | From Table 4-3 in USEPA (1993) |
| AE | Weighted Assimilation Efficiency (%) | 75% | Calculated based on assimilation efficiency for individual food items. |
| $FR_{soil}$ | Percent Soil/Sediment in Diet | 2.8% | Assumed similar to other terrestrial predators from USEPA (1993) |
| IR | Food Ingestion Rate (kg/day dry wt.) | 0.021 | Calculated using equation 3-3 of USEPA (1993) |

Notes:

1. Food items are abbreviated as: Inv = Invertebrates; SM = Small mammals, Veg = Vegetation.

**Table**

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

**Soil Screening - Acid Plant Area - Ecological Criteria**

| Sample ID<br>Sample Depth (Feet)<br>Date Collected | Reference Concentration | Ecological Criteria | AW/SS-1<br>0 - 0.5<br>10/22/03 | AW/SS-2<br>0 - 0.5<br>10/22/03 | AW/SS-3<br>0 - 0.5<br>10/22/03 | DA/SS-1<br>0 - 0.5<br>10/21/03 | DA/SS-2<br>0 - 0.5<br>10/21/03 | DA/SS-3<br>0 - 0.5<br>10/21/03 | DA/SS-4<br>0 - 0.5<br>10/21/03 | DA/SS-5<br>0 - 0.5<br>10/21/03 | DA/SS-6<br>0 - 0.5<br>10/21/03 | DA/SS-7<br>0 - 0.5<br>10/21/03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 15 | 60 | 1.5 | 5.6 | 5 [7.1] | 8.2 | 6.4 B | ***35 [36]*** | 5.8 | 11 | 6.6 | ***19*** |
| Lead | 281 | 500 | 16 | 130 | 83 [86] | ***5200 J*** | ***400 J*** | ***1600 J [1400 J]*** | ***340 J*** | ***28000 J*** | ***420 J*** | ***400 J*** |
| Mercury | 0.15 | 0.1 | 0.03 | 0.055 | 0.12 [0.15] | ***1.2 J*** | ***0.3 J*** | ***0.69 J [0.76 J]*** | ***0.36 J*** | ***0.85 J*** | ***0.27 J*** | ***0.18 J*** |

| Sample ID<br>Sample Depth (Feet)<br>Date Collected | Reference Concentration | Ecological Criteria | DA/SS-8<br>0 - 0.5<br>10/21/03 | DA/SS-9<br>0 - 0.5<br>10/21/03 | DA/SS-10<br>0 - 0.5<br>10/21/03 | DA/SS-11<br>0 - 0.5<br>01/12/05 | DA/SS-12<br>0 - 0.5<br>01/12/05 | DA/SS-13<br>0 - 0.5<br>01/12/05 | DA/SS-14<br>0 - 0.5<br>01/12/05 | DA/SS-15<br>0 - 0.5<br>01/12/05 | DA/SS-16<br>0 - 0.5<br>01/12/05 | GP-SB-01<br>0 - 0.5<br>02/16/05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 15 | 60 | 3.6 | ***45*** | 5.7 | 4 [10] | 10 | 1.3 B | 2.9 | 2.2 | ***27*** | 2 |
| Lead | 281 | 500 | ***1200 J*** | 270 J | 80 J | 170 J [190 J] | ***550 J*** | 140 J | 160 J | 69 J | 100 J | 15 |
| Mercury | 0.15 | 0.1 | 0.068 J | ***0.14 J*** | 0.081 J | ***1.6 J [0.18 J]*** | ***0.4 J*** | 0.063 J | 0.049 J | 0.062 J | 0.038 J | 0.023 |

| Sample ID<br>Sample Depth (Feet)<br>Date Collected | Reference Concentration | Ecological Criteria | GP-SB-02<br>0 - 0.5<br>02/16/05 | GP-SB-03<br>0 - 0.5<br>02/16/05 | GP-SB-04<br>0 - 0.5<br>02/16/05 | GP-SB-05<br>0 - 0.5<br>02/16/05 | GP-SB-06<br>0 - 0.5<br>02/16/05 | GP-SB-07<br>0 - 0.5<br>02/16/05 | GP-SB-08<br>0 - 0.5<br>02/16/05 | GP-SB-09<br>0 - 0.5<br>02/16/05 | GP-SB-10<br>0 - 0.5<br>02/16/05 | GP-SB-11<br>0 - 0.5<br>02/16/05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 15 | 60 | 1.7 | 1.9 | ***18*** | ***39*** | ***81*** | 12 | ***16*** | 11 | 4.4 | 1.8 |
| Lead | 281 | 500 | 18 | 21 | ***3500*** | ***6700*** | ***7300*** | ***10000*** | ***36000*** | ***8400*** | 200 | 19 |
| Mercury | 0.15 | 0.1 | 0.034 | 0.032 | ***0.24*** | ***0.6*** | ***0.74*** | ***0.58*** | ***0.21*** | ***0.21*** | ***0.17*** | 0.024 B |

| Sample ID<br>Sample Depth (Feet)<br>Date Collected | Reference Concentration | Ecological Criteria | GP-SB-12<br>0 - 0.5<br>02/16/05 | GP-SB-13<br>0 - 0.5<br>02/16/05 | GP-SB-14<br>0 - 0.5<br>02/16/05 | GP-SB-15<br>0 - 0.5<br>02/16/05 | GP-SB-16<br>0 - 0.5<br>02/16/05 | GP-SB-17<br>0 - 0.5<br>02/16/05 | GP-SB-18<br>0 - 0.5<br>02/16/05 | GP-SB-19<br>0 - 0.5<br>02/16/05 | GP-SB-20<br>0 - 0.5<br>02/17/05 | GP-SB-21<br>0 - 0.5<br>02/17/05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals (mg/kg)** | | | | | | | | | | | | |
| Arsenic | 15 | 60 | 6.9 | ***19*** | 8.3 | ***21*** | 8.9 | 1.6 | 1 B | ***300*** | 11 | 8.1 |
| Lead | 281 | 500 | 190 | ***6100*** | ***1400*** | ***2400*** | ***1700*** | 19 | 13 | ***4800*** | ***9600*** | ***1200*** |
| Mercury | 0.15 | 0.1 | ***0.16 B*** | ***1.3 B*** | ***0.74 B*** | ***0.81 B*** | ***0.13 B*** | 0.029 B | 0.028 B | ***2.7 B*** | ***0.64*** | ***0.49*** |

| Sample ID<br>Sample Depth (Feet)<br>Date Collected | Reference Concentration | GP-SB-22<br>0 - 0.5<br>02/17/05 | GP-SB-23<br>0 - 0.5<br>02/17/05 | SB/SS-13<br>0 - 0.5<br>01/12/05 |
|---|---|---|---|---|
| **Metals (mg/kg)** | | | | |
| Arsenic | 15 | 6.7 | 1.6 [1.4 B] | 3.4 |
| Lead | 281 | ***1800*** | 76 [79] | 20 J |
| Mercury | 0.15 | ***0.14*** | 0.064 [0.058] | ***0.11*** |

Notes:

1. The reference concentrations are equal to two times the average background concentrations.
2. Ecological soil criteria are ORNL soil screening benchmarks for invertebrates (Efroymson et al., 1997).

Shaded values exceed the Ecological Soil Criteria

***Bolded/italic values exceed the reference concentration.***

**Table**

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

**Sediment Screening - Acid Plant Area - Ecological Criteria**

| Sample ID / Sample Depth (ft) / Date Collected | Reference Concentration | Ecological Criteria | Consensus Based Guidelines[3] | | AW/SD-4 0 - 0.5 01/11/05 | AW/SS-1 0 - 0.5 10/22/03 |
|---|---|---|---|---|---|---|
| | | | TEC | PEC | | |
| **Metals (mg/kg)** | | | | | | |
| Arsenic | 6.8 | 8.2 | 9.79 | 33.0 | 6.4 | 1.5 |
| Lead | 178 | 47 | 35.8 | 128 | ***180*** | 16 |
| Mercury | 0.13 | 0.15 | 0.18 | 1.06 | ***0.17*** | 0.03 |

Notes:

1. The reference concentrations are equal to two times the average background concentrations.
2. Sediment benchmarks are USEPA (1996) OSWER Ecotox Thresholds for sediments.
3. Consensus-based sediment quality guidelines include threshold effect concentration (TEC) and probable effect concentration (PEC) values from MacDonald et al. (2000).

Shaded values exceed the Ecological Sediment Criteria

***Bolded/italic values exceed the reference concentration***

**Table**

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

**Surface Water Screening - Acid Plant Area - Ecological Criteria**

| Sample ID<br>Date Collected | Reference Concentration | Ecological Criteria | AW/SW-1<br>03/16/04 | AW/SW-4<br>01/11/05 |
|---|---|---|---|---|
| **Metals (ug/L)** | | | | |
| Arsenic | 8.7 | 190 | 6.1 B [10 U] | 10 U |
| Lead | 51.6 | 1.74 | 45 [43] | 34 |
| Mercury | ND | 0.012 | 0.2 U [0.2 U] | 0.2 U |
| **Metals-Dissolved (ug/L)** | | | | |
| Arsenic | ND | 190 | 10 U [10 U] | 10 U |
| Lead | ND | 1.74 | 44 [42] | 9.6 |
| Mercury | ND | 0.012 | 0.2 U [0.2 U] | 0.2 U |
| **Miscellaneous (ug/L)** | | | | |
| Hardness as $CaCO_3$ | -- | -- | 84000 [85000] | 40000 |

Notes:

1. The reference concentrations are equal to two times the average background concentrations.
2. Surface water benchmarks are USEPA Region 4 (2001) surface water screening values. Lead value is calculated based on a site-specific average hardness of 62,250 ug/L.

Shaded values exceed the Ecological Surface Water Criteria

ND = The reference concentrations were all non-detect.

Table

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

**Ecological Toxicological Reference Values - Acid Plant Area**

| Constituent/ Receptor Group | Original TRV[1] NOAEL (mg/kg-day) | LOAEL (mg/kg-day) | Species | Endpoint | Reference | Species-Specific TRV[2] NOAEL (mg/kg-day) | LOAEL (mg/kg-day) | Adjustment Factors BW Test (kg) | BW Target (kg) |
|---|---|---|---|---|---|---|---|---|---|
| **USEPA-Recommended TRVs[3]** | | | | | | | | | |
| Lead | | | | | | | | | |
| Short-tailed shrew | 0.3 (a) | 3.3 (a) | rat | mortality | (Schroeder and Mitchner, 1971) | 0.70 | 7.03 | 0.35 | 0.017 |
| Raccoon | 0.3 (a) | 3.3 (a) | rat | mortality | (Schroeder and Mitchner, 1971) | 0.16 | 1.64 | 0.35 | 5.78 |
| Long-tailed weasel | 0.3 (a) | 3.3 (a) | rat | mortality | (Schroeder and Mitchner, 1971) | 0.36 | 3.77 | 0.35 | 0.205 |
| American robin | 1.5 (10 ppm) | 15 (100 ppm) | Japanese quail | reproduction | (Edens et al., 1976) | 1.50 | 15.00 | -- | -- |
| Green heron | 1.5 (10 ppm) | 15 (100 ppm) | Japanese quail | reproduction | (Edens et al., 1976) | 1.50 | 15.00 | -- | -- |
| Common screech owl | 1.5 (10 ppm) | 15 (100 ppm) | Japanese quail | reproduction | (Edens et al., 1976) | 1.50 | 15.00 | -- | -- |
| Mercury | | | | | | | | | |
| Short-tailed shrew | 0.015 (0.1 ppm) | 0.075 (0.5 ppm) | mink | reproduction | (Dansereau et al., 1999) | 0.04 | 0.21 | 1 | 0.017 |
| Raccoon | 0.015 (0.1 ppm) | 0.075 (0.5 ppm) | mink | reproduction | (Dansereau et al., 1999) | 0.01 | 0.06 | 1 | 5.78 |
| Long-tailed weasel | 0.015 (0.1 ppm) | 0.075 (0.5 ppm) | mink | reproduction | (Dansereau et al., 1999) | 0.02 | 0.11 | 1 | 0.205 |
| American robin | 0.06 (0.5 ppm) | 0.35 (3.0 ppm) | mallard | mortality | (Heinz, 1976) | 0.06 | 0.35 | -- | -- |
| Green heron | 0.06 (0.5 ppm) | 0.35 (3.0 ppm) | mallard | mortality | (Heinz, 1976) | 0.06 | 0.35 | -- | -- |
| Common screech owl | 0.06 (0.5 ppm) | 0.35 (3.0 ppm) | mallard | mortality | (Heinz, 1976) | 0.06 | 0.35 | -- | -- |
| **Alternate TRVs** | | | | | | | | | |
| Arsenic | | | | | | | | | |
| Short-tailed shrew | 2.5 | 25 | rat | reproduction | (Holsen et al., 2000) b | 9.33 | 93.25 | 0.35 | 0.017 |
| Raccoon | 2.5 | 25 | rat | reproduction | (Holsen et al., 2000) b | 1.24 | 12.40 | 0.35 | 5.78 |
| Long-tailed weasel | 2.5 | 25 | rat | reproduction | (Holsen et al., 2000) b | 2.86 | 28.58 | 0.35 | 0.205 |
| American robin | 1.5 (11.1 ppm) | 5.4 (33.3 ppm) | cowbird | mortality | (USFWS, 1969) | 1.51 | 5.44 | -- | -- |
| Green heron | 6 (51.4 ppm) | 15 (128 ppm) | mallard | mortality | (USFWS, 1964) | 6.01 | 14.98 | -- | -- |
| Common screech owl | 6 (51.4 ppm) | 15 (128 ppm) | mallard | mortality | (USFWS, 1964) | 6.01 | 14.98 | -- | -- |
| Lead | | | | | | | | | |
| Short-tailed shrew | 8 (100 ppm) | 80 (1,000 ppm) | rat | reproduction | (Azar et al., 1973) | 17.04 | 170.41 | 0.35 | 0.017 |
| Raccoon | 8 (100 ppm) | 80 (1,000 ppm) | rat | reproduction | (Azar et al., 1973) | 3.97 | 39.68 | 0.35 | 5.78 |
| Long-tailed weasel | 8 (100 ppm) | 80 (1,000 ppm) | rat | reproduction | (Azar et al., 1973) | 9.14 | 91.45 | 0.35 | 0.205 |
| American robin | 1.5 (10 ppm) | 15 (100 ppm) | Japanese quail | reproduction | (Edens et al., 1976) | 1.50 | 15.00 | -- | -- |
| Green heron | 1.5 (10 ppm) | 15 (100 ppm) | Japanese quail | reproduction | (Edens et al., 1976) | 1.50 | 15.00 | -- | -- |
| Common screech owl | 1.5 (10 ppm) | 15 (100 ppm) | Japanese quail | reproduction | (Edens et al., 1976) | 1.50 | 15.00 | -- | -- |
| Mercury | | | | | | | | | |
| Short-tailed shrew | 0.017 (c) | 0.165 (1.1 ppm) | mink | systematic | (Wobeser et al., 1976) | 0.05 | 0.46 | 1 | 0.017 |
| Raccoon | 0.017 (c) | 0.165 (1.1 ppm) | mink | systematic | (Wobeser et al., 1976) | 0.01 | 0.11 | 1 | 5.78 |
| Long-tailed weasel | 0.017 (c) | 0.165 (1.1 ppm) | mink | systematic | (Wobeser et al., 1976) | 0.02 | 0.25 | 1 | 0.205 |
| American robin | 0.6 (4 ppm) | 1.2 (8 ppm) | Japanese quail | reproduction | (Hill and Schaffner, 1976) | 0.60 | 1.20 | -- | -- |
| Green heron | 0.6 (4 ppm) | 1.2 (8 ppm) | Japanese quail | reproduction | (Hill and Schaffner, 1976) | 0.60 | 1.20 | -- | -- |
| Common screech owl | 0.6 (4 ppm) | 1.2 (8 ppm) | Japanese quail | reproduction | (Hill and Schaffner, 1976) | 0.60 | 1.20 | -- | -- |

Notes:
1. Original TRVs as reported in the primary literature. Dietary concentrations (in ppm) are converted to daily dosage (in mg/kg body weight-day) using the test species body weight and food ingestion rate presented in the Step 3 Report (BBL, 2002).
2. For mammals, the final TRVs are adjusted for the body weight of the test species and wildlife species, using the following equation: $TRV_{target} = TRV_{test} * ((BW_{test}) / (BW_{target}))^{0.25}$.
3. USEPA did not recommend specific TRVs for arsenic.
(a) LOAEL based on exposure to lead at 25 mg/L in drinking water and 0.20 mg/kg in food.
(b) LOAEL was calculated by multiplying the NOAEL reported in the study by a safety factor of 10.
(b) NOAEL was calculated by dividing the LOAEL reported in the study by a safety factor of 10.
NOAEL = No Observed Adverse Effects Level
LOAEL = Lowest Observed Adverse Effects Level

**Table**

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

Hazard Quotient Summary - Pesticide Burial Area

| | NOAEL-Based HQs | | | LOAEL-Based HQs | | |
|---|---|---|---|---|---|---|
| **Species** | **DDT** | **endrin** | **toxaphene** | **DDT** | **endrin** | **toxaphene** |
| **Conservative Exposure Assumptions and USEPA-Recommended TRVs** | | | | | | |
| Shorttail Shrew | 0.0010 | 0.0100 | 0.0436 | 0.0002 | 0.0050 | 0.0174 |
| Raccoon | 0.0027 | 0.0144 | 0.0602 | 0.0005 | 0.0072 | 0.0241 |
| Longtail Weasel | 0.0028 | 0.0137 | 0.0576 | 0.0006 | 0.0068 | 0.0230 |
| American Robin | 0.0194 | 0.0434 | 0.1086 | 0.0099 | 0.0072 | 0.0217 |
| Green Heron | 0.0180 | 0.0585 | 0.1459 | 0.0092 | 0.0097 | 0.0292 |
| Screech Owl | 0.0028 | 0.0265 | 0.0660 | 0.0003 | 0.0044 | 0.0132 |
| **Realistic Exposure Assumptions and Alternate TRVs** | | | | | | |
| Shorttail Shrew | 0.0002 | 0.0085 | 0.0174 | 0.0001 | 0.0017 | 0.0044 |
| Raccoon | 0.0002 | 0.0030 | 0.0060 | 0.0001 | 0.0006 | 0.0015 |
| Longtail Weasel | 0.0004 | 0.0058 | 0.0115 | 0.0002 | 0.0012 | 0.0029 |
| American Robin | 0.0003 | 0.0017 | 0.0095 | 0.0000 | 0.0006 | 0.0019 |
| Green Heron | 0.0011 | 0.0066 | 0.0365 | 0.0001 | 0.0022 | 0.0073 |
| Screech Owl | 0.0007 | 0.0030 | 0.0165 | 0.0001 | 0.0010 | 0.0033 |

Notes:

1. Hazard quotients (HQs) are calculated as the potential average daily dose (in mg/kg-day) divided by the toxicity reference value (in mg/kg-day).

**Table**

**Ecological**
**Summary of Risk-Based Soil Concentrations for Lead - Acid Plant Area**

| Species | NOAEL-Based Soil RBCs (mg/kg dry weight) | LOAEL-Based Soil RBCs (mg/kg dry weight) | Average Soil RBC [2] (mg/kg dry weight) |
|---|---|---|---|
| **Conservative Exposure Assumptions and USEPA-Recommended TRVs** | | | |
| Shorttail Shrew | 30 | 300 | 90 |
| Raccoon | 38 | 380 | 120 |
| Longtail Weasel | 160 | 1,600 | 500 |
| American Robin | 39 | 390 | 120 |
| Screech Owl | 150 | 1,500 | 470 |
| **Realistic Exposure Assumptions and Alternate TRVs** | | | |
| Shorttail Shrew | 740 | 7,400 | 2,340 |
| Raccoon | 3,700 | 37,000 | 11,700 |
| Longtail Weasel | 7,800 | 78,000 | 24,700 |
| American Robin | 140 | 1,400 | 440 |
| Screech Owl | 610 | 6,100 | 1,900 |

Notes:

1. Risk-based concentrations (RBCs) for lead in soil were back-calculated using the food web models and are based on a hazard quotient (HQ) of 1.
2. The average RBC represents the geometric mean of the NOAEL-based RBC and the LOAEL-based RBC for each receptor.

TRVs = Toxicity Reference Values
NOAEL = No-Observed-Adverse-Effects-Level
LOAEL = Lowest-Observed-Adverse-Effects-Level
mg/kg = milligrams per kilogram

**Table**

**Gurley Pesticide Burial Site**
**Selma, North Carolina**

**Calculation of Risk-Based Soil Concentrations for Lead Using Realistic Exposure and TRV Assumptions**
**Acid Plant Area - American Robin**

**Step 1: Calculation of Site-Specific Bioaccumulation Factor (BAF) for Invertebrate**

**BAF Equation:**

**BAF = Cf / (Cs * % solid)**

| | | lead | |
|---|---|---|---|
| BAF = | Site-specific invertebrate BAF for lead based on average soil and tissue concentrations | 0.31 | unitless |
| Average Tissue Concentration | | lead | |
| Cf = | Average tissue concentration (arithmetic mean of site-specific invertebrate data) | 158 | mg/kg (wet weight) |
| Average Soil Concentration | | lead | |
| Cs = | Average concentration in soil (arithmetic mean of site-specific soil data) | 3,190 | mg/kg (dry weight) |
| % solid = | Percent solid of invertebrate (earthworm) tissue | 0.16 | Source: USEPA, 1993 |

**Step 2: Calculation of Site-Specific Risk-Based Concentration (RBC) for Lead in Soi**

**RBC Equation:**

**Soil RBC = (TRV * BW * HQ) / ((BAF * % solid * FR * NIR * BW) + (FS * NIR * % solid * BW * FR))**

| | | | |
|---|---|---|---|
| Where: | | | |
| FR = | Percent of diet from the site | 25% | |
| NIR = | Normalized ingestion rate | | |
| | NIR = [(NFMR) / (ME)] | 0.83 g/g-day | |
| | Where: | | |
| | NFMR = Free-living metabolic rate | 0.71 kcal/g-day | |
| | ME = Metabolizable energy = [(GE) x (AE)] | 0.86 kcal/g | |
| | GE = Gross energy | 1.30 kcal/g (wet wt) | |
| | AE = Assimilation efficiency | 66% | |
| FS = | Estimated percent soil in diet | 3% | |
| BW = | Body weight | 0.08 kg | |
| **HQ =** | **Hazard Quotient** | **1** | |
| TRV = | Toxicity reference value | NOAEL (mg/kg-day) | LOAEL (mg/kg-day) |
| | lead | 1.50 | 15.00 |

| | | |
|---|---|---|
| **NOAEL-Based Soil RBC =** | **140** | mg/kg (dry weight) |
| **LOAEL-Based Soil RBC =** | **1,400** | mg/kg (dry weight) |

# PART 7: STATE CONCURRENCE LETTER

NCDENR
North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director | Division of Waste Management | Michael F. Easley, Governor
William G. Ross Jr., Secretary

22 September 2006

Mr. Randy Bryant
Remedial Project Manager
Superfund Remedial & Site Evaluation Branch
US EPA Region IV
61 Forsyth Street. SW
Atlanta, Georgia 30303

SUBJECT: Conditional Concurrence with Record of Decision
Gurley Pesticide Burial Site
Selma, Johnston County

Dear Mr. Bryant:

The State of North Carolina has reviewed the Record of Decision (ROD) received by the Division on 21 September 2006 for the Gurley Pesticide Burial Site and concurs with the selected remedy, subject to the following conditions:

1. State concurrence on the ROD for this site is based solely on the information contained in the ROD received by the State on 21 September 2006. Should the State receive new or additional information which significantly affects the conclusions or remedies contained in the ROD, it may modify or withdraw this concurrence with written notice to EPA Region IV.

2. State concurrence on this ROD in no way binds the State to concur in future decisions or commits the State to participate, financially or otherwise, in the clean up of the site. The State reserves the right to review, overview comment, and make independent assessment of all future work relating to this site.

3. State concurrence on the ROD for this site is based on the removal of soils from this site with lead concentrations exceeding 400 ppm to achieve the NCDENR Inactive Hazardous Sites Program soil remedial goal for unlimited use and unrestricted exposure. If it can be demonstrated that the cost incurred to attain this reduction from the Ecological Risk Assessment based 440 ppm clean-up level proposed by EPA would be excessive, then adherence to the 440 ppm clean-up level would be required and the State would require recordation of land use restrictions to document the presence of residual contamination and limit future use of the property.

4. The 15A NCAC 2L Groundwater Standard for manganese is 0.05 mg/l. The State does not agree that this ARAR should be waived from the ROD as indicated by its absence from Table 12 of the ROD. The State expects the groundwater standard for manganese to be achieved before the remediation process is complete and the Site is closed out. The State does not intend that this condition interfere with the implementation of the proposed remedies as stated in the ROD.

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The State of North Carolina appreciates the opportunity to comment on the ROD and looks forward to working with EPA on the remedies for the subject site. If you have any questions or comments, please call Harry Zinn at 919 508-8488.

Sincerely,

James Bateson, Head
Site Evaluation and Removal Branch
Superfund Section

cc: Jack Butler, Chief NC Superfund Section
Harry Zinn, NC Superfund
David Lown, NC Superfund